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THE BLOSSEVILLE COAST OF EAST GREENLAND: *A paper read at the Evening Meeting of the Society on 6 February 1933, by*

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TO any one who has travelled along the east coast of Greenland from the most northerly point to Angmagssalik, there is something very sad indeed, everywhere along this immense stretch of coast, to find very many traces of a previously fairly dense habitation; to find remains of stone huts, where happy contented people used to live; to find big cairns where the Eskimo of olden days hid his surplus meat; to find traps for foxes and bears, ingeniously constructed from stones by these clever hunting people; to find implements which show what a high standard of development the hunting culture of these people from the Stone Age reached; to see stone graves where at last the nomadic hunter, his womenfolk and his children, found eternal rest; or to find skeletons of men, women, and children in the ruined huts: a sad and bitter trace of a tragedy, a grim reminder that after the sunny days of the summer came the cold winter, with storm and blizzard, starvation and death.

Almost everywhere along this 2500-kilometre-long stretch of coast, with its deep fjords and headlands, in the sunny valleys, or on the low coast of the North-east land, we find these numerous traces, which tell us that the land once gave the means of existence for a rather numerous tribe of Eskimos. But hard times fell on the tribe, it dwindled and at last disappeared. Only once has the North-east Greenland Eskimo been definitely seen by a European: in 1823, when Clavering, on the island which now bears his name, found twelve people who disappeared, frightened by the presence of the white man, and who have never been seen since.

But the explorer who now travels along this coast and sees these sad remains is time and again touched by the tragedy of the tribe which one can hardly understand. Undoubtedly the Eskimo are the most clever hunting people of the world, and there must have been in the past, as there is now, plenty of game: seals, walrus, and narwhal in the water, and bears on the ice and land, while reindeer previously lived on the coast in great numbers, of which the shed horns bear ample witness. The reindeer have however now disappeared, but the musk-oxen have partly replaced them and are now fairly numerous. There is also plenty of bird life, as well as places where valuable fur animals

such as foxes are common. As the sea and land thus yields plenty of food, the Eskimo of olden days and their close relatives the Greenlanders of to-day were and are able to find sufficient means for existence; and when one has considered sufficiently long the tragedy of the tribe which has now disappeared, it is easily understood that this thought comes to the mind of the observer: Why not try to recreate the human activity, which once existed along these now so barren and empty stretches of coast, by creating again the basis of existence for the enterprising Greenlander, whose only means of livelihood is hunting?

The East Coast of Greenland from Scoresby Sound to Angmagssalik

During my three years' stay on the east coast of Greenland, principally on Shannon Island and the Bass Rock from 1909–1912, this thought often occupied my mind, and I formed a plan to colonize Scoresby Sound. But many years elapsed before it could be realized, as the Danish Government feared, for one thing that the Angmagssalik Greenlanders would not be able to settle down so much farther north than their original homes, and also that the establishment and the running of a settlement in such a far-off place, which necessitated a ship calling yearly, would be too costly an undertaking compared with the probable income.

However, while this matter was being considered in Denmark the Angmagssalik tribe steadily grew in numbers, and had almost doubled since the settlement was first established in 1894, with the result that the hunting which could be obtained within the relatively narrow boundaries of the settlement was too small to feed the constantly growing number of Greenlanders. This caused the enterprising Angmagssalik hunter to recommence about 1920 the long hunting journeys to territories which were known from olden times, but which had almost been abandoned for half a century, especially south of the settlement. It became more and more evident that something had to be done to safeguard the progress of the tribe and the means of existence for the growing population, as it was natural that only a rather limited number of people could live by hunting within this confined territory.

When in 1924 the East Greenland Treaty was concluded between Denmark and Norway, the above fact was borne in mind by the Danes, and subject to certain conditions a good hunting territory, Scoresby Sound (discovered by the famous English whaler and scientist, Wm. Scoresby, junior), was reserved for the Greenlanders. In this way the foundation was at last laid for carrying out the old plan; the means for creating a colony were provided by a private committee, named the *Scoresby Sound Committee*, and on 10 July 1924 the Colonization Expedition, under my leadership, sailed from Copenhagen to Scoresby Sound on board the expedition's ship *Grönland*.

Luck was with us. Ice conditions were then, as they have been afterwards, good for a direct navigation of the fjord, instead of the devious but time-honoured route through the North Bay in about 75° N. Fairly early in the year we succeeded in getting in, although with a damaged ship, the rudder and rudder-post being smashed in heavy ice-pressure at the mouth of the fjord. But in spite of everything we got in and found a sheltered harbour, Amdrup Harbour, on the north side of which the foundation of the settlement was laid.

There, as well as at other suitable places in the neighbourhood of Amdrup Harbour, houses were built for the administration and the Greenlanders, and a storehouse was erected in which food and other material was stored for three to four years for about one hundred Greenlanders. Then, when our work was finished, and the autumn forced us to leave the sheltered harbour and to venture out with our damaged ship through the ice and over the North Sea and back home, we left six of our comrades at Scoresby Sound, partly in order to finish the building of the ten Greenlander houses, and partly to do scientific work, especially a thorough zoological investigation of the existing animals of the fjord.

The finished settlement was presented to the Danish Government, who next year transferred eighty-five Greenlanders from Angmagssalik to Scoresby Sound, with all their possessions, sledges, kayaks, skin tents, weapons, and household goods. Many more would have liked to go, but the authorities did not dare to allow more than the original eighty-five, for they wished to obtain practical experience of the conditions of living in Scoresby Sound before giving permission for further Greenlanders to be transferred. Both from Angmagssalik and from the west coast of Greenland many requests were made by the Greenlanders to be transferred to the new colony, but for the reasons above mentioned these requests have up to the present been refused.

The transferred Greenlanders settled down in their new surroundings and made themselves at home in the new houses which, when judged by the usual Greenland dwelling-places, were big. Hunting conditions were good. Quantities of seals were found in the sea and a fairly large number of walrus, which however are now more scarce, as this animal does not thrive where men live. Narwhal were caught in fair quantity, and birds too, in increasing numbers, as the Greenlanders discovered fowling cliffs on the islands and mountains along the Liverpool Coast. They also caught many bears. Foxes were plentiful, and were to begin with very tame, as they had not been hunted for a hundred years or more: not since the many Eskimo who had formerly lived in Scoresby Sound, and of whom we found numerous traces everywhere, had died or emigrated.

The musk-ox we found peacefully grazing on the land in fairly great numbers, but as the Greenlanders, in contrast with the European hunter farther north, are not permitted to kill these animals except in self-defence, or if the seal-hunting has failed, the existence of musk oxen is of less importance, except as an emergency food. But it does happen that the musk-ox is too venturesome, and that the Greenlander has to shoot them to protect the dogs, etc., and in this way secures meat for a long time.

Altogether, hunting conditions in Scoresby Sound must be called good, better than in the Angmagssalik district, and as there is plenty of food in the sea for the seals, and as the seals are necessary for the existence of the bears, and there are plenty of hares and marmot on land, giving food for the foxes and ermines, there is no danger that the animals in the sea and the fur-yielding animals will be extinguished or reduced in number, if hunted in a proper way.

On land the vegetation is fairly rich. Great areas are covered with heather and grass. The dwarf willow, the most important food for the musk-ox, is to be found everywhere, and in summer time one can almost talk of a wealth of flowers, especially far up the fjord from Point Hope and inland; whereas the outer territories of the fjord, where the centre of the settlement has been established, are bare and almost without vegetation, owing to the raw climate of the coast, which, with its fog and mist, is felt a fair distance inland.

The settlement is constantly being extended. The Danish Government in 1927 erected a wireless and seismograph station in its midst. The Scoresby Sound Committee have, as far as they have had the means during the past years, given a number of houses for those Greenlanders for whom there was no independent house available from the beginning or for those who later on had use for such houses; and in 1927 a member of the Committee gave a beautiful church to the newly established settlement. New storehouses, coal sheds, and a new shop have been erected on the Government's account, and where eight years ago not a single human being was to be found, and only traces of their previous doings were discovered in the form of ruined stone huts, now live about 150 Greenlanders safely and well. Attractive wooden houses are to be found along the coast which was previously so barren, not only in the settlement itself, but also at one or two outposts where the Greenlanders live; and some hunting huts also have been built on the Liverpool Coast and far up the great fjords, where there are plenty of bears, especially in spring.

D'Aunay Fjord

Receding glacier at D'Aunay Bay

Typical glacier on the Blosseville coast

Mikis Fjord

The establishment of the Scoresby Sound settlement has also enabled expeditions to work fairly cheaply in a territory which was previously very expensive to visit. Thus Dr. Lauge Koch in 1926 began his detailed examination of the east coast with Scoresby Sound as the starting-point; and helped partly by the Committee, the zoologist Alwin Petersen has spent three years in the fjord territory to thoroughly examine the fauna. While Denmark has gained a new Greenland settlement, the Danish scientific work in East Greenland has thus secured a far northern base, and most of all the enterprise has been of the greatest help to the Greenlanders, who here at Scoresby Sound have found a new hunting territory, which promises to last long, and from which they may, I hope, in years to come, when the tribe has grown sufficiently, spread farther north, to live under secure conditions in places where ruined stone huts tell us of their forefathers' fight for life and bitter defeat of more than a hundred years ago.

The Scoresby Sound settlement was however rather far away from Angmagssalik, and during many years the Committee were considering plans to create a kind of connection between the two settlements. It was a rather difficult task to take up, for the stretch of coast between the two settlements is no doubt one of the most difficult to approach in the whole stretch of East Greenland, as the ice is pressed towards land, probably due to the narrowing of the Strait between Greenland and Iceland, and possibly also from other causes.

The first authentic knowledge of the coast between Scoresby Sound and Angmagssalik dates from 1822, when the famous English whaler, William Scoresby, junior, mapped the most northerly part from his ship at a distance of about 20 miles from land; and later on, in 1892, the Dane C. Ryder saw the same stretch of coast from about the same distance. In 1832 the French naval lieutenant Blosseville succeeded in approaching the coast until he was about 70 miles away, and from this position he drew a very rough map of the unknown land, which he saw far north and which now bears his name. Blosseville returned to Iceland, and having dispatched information home of his discovery, he left again for the Greenland coast, where he and his ship disappeared, probably crushed in the ice.

In 1884–85 the Dane Gustav Holm in Angmagssalik obtained information from the Eskimos of the land farther to the north, and on this basis he drew a surprisingly good map of the coast from Angmagssalik to Kangerdlugsuak and Nuna Isua, the Land's End of the Eskimos, the farthest land they had ever seen towards north. In 1893 the Norwegian Ragnvald Knudsen, on board the sealing ship *Hekla*, steamed through the ice and got nearer to the Blosseville coast than any man had previously been, and at a distance of about 15 miles off land he saw two fjords cut into the land, but the ice made it impossible for him to approach nearer.

It was only in 1899–1900 that definite information was obtained of the coast between Scoresby Sound and Angmagssalik, when G. Amdrup, by means of rowing boat and sledge, examined the coast north of Angmagssalik to Nualik in 1899, and in 1900 concluded the great boat journey from Cape Dalton to Angmagssalik, which resulted in the mapping and a partial scientific examination of the whole stretch of coast. I had the good fortune to be a junior member of this expedition, and had thus a personal knowledge of the coast.

Lastly in 1930 the energetic English traveller, H. G. Watkins, whose tragic death last autumn is still fresh in our minds, succeeded in taking his ship towards the north from Angmagssalik along the coast to the big Kangerdlugsuak fjord, which he examined and mapped, and where the geologists of the expedition found certain interesting rocks.

This is the history of the coast and what was known of it, but no ship had ever sailed the stretch from Cape Dalton to Kangerdlugsuak, and no trained scientist had landed on this same coast; while the many fjords which Amdrup had seen were unknown. There was thus plenty of work to do for a scientific expedition, especially because this stretch of coast forms the dividing line between the fauna and flora of southern and northern Greenland.

It was to this stretch of coast that the Scoresby Sound Committee decided to send an expedition with the double purpose of creating possibilities of existence for the Greenlanders, and of examining the coast, especially its animal life, which was of the greatest importance if we were to be sure that one could, with a good conscience, allow Greenlanders to settle there.

We knew that in 1928 Greenlanders from Angmagssalik, to the number of 117, had travelled northward towards the hunting Eldorado of the myth, Kangerdlugsuak, and though the greater part of them had reached no farther than Nualik, where they wintered, a few of the more energetic hunters sledged farther north to Kangerdlugsuak, the most south-westerly point of which they reached. The Eskimos themselves had thus shown the way, and through their attempt to reach Kangerdlugsuak they had already expressed the wish to settle in the fjord, a wish we would gladly further by building houses for the enterprising people in the big fjord territory, thereby creating an outpost for Angmagssalik. At the same time we wanted to build a few houses on the coast, so that in the future there would be a chain of houses from Scoresby Sound to Angmagssalik, which would enable the Eskimos to travel from one settlement to the other. This, and the scientific examination of the Blosseville coast, was the aim of the Scoresby Sound Committee's Second East Greenland Expedition.

A suitable ship, the *Sökongen*, was placed at the disposal of the Committee, and on 22 June 1932 we left for Cape Dalton, having on board nine scientists and assistants, apart from the crew of the ship, altogether seventeen men. 1932 was a very good ice year off south-east Greenland, and it was exceptionally easy to approach the land. On July 10, in the morning, we headed towards the east coast of Greenland, and sailed through an opening in the ice-pack. To the north and south we could see heavy pack-ice which came nearer as we approached land. We were sailing as in a big triangle—the broad side to the sea, and the point of the triangle towards land—and after only a few hours of what could not really be called ice navigation, we passed the first of the many icebergs floating along the coast, and reached the exact spot where we wished to land, Cape Dalton, the most southerly point a ship had reached on this stretch of coast, and where our work was to begin.

At twelve o'clock noon we anchored off Amdrup's depot, surviving from 1900, and while the scientists and the cartographers of the expedition, glad to escape the somewhat confined space of the *Sökongen*, began their work of collecting and examining the geology of the country, its fauna and flora, the

crew arranged the depot, and repaired it as well as the time and the spare materials at our disposal permitted. From Cape Dalton we sailed slowly down the coast, at times in brilliant sunshine when the wild rugged country, the dark basaltic rocks, and the glistening inland ice could be seen far and wide; and at other times, and more often, in dense fog when ice-floes and icebergs would suddenly loom up right ahead of the ship, or dark shadows in the fog caused us to be careful: the land was near.

The aim of the expedition was to investigate as much of the country as possible, and to map as many fjords as we could in the time at disposal. Where conditions seemed good we searched along the coast of the fjords and anchored in the best protected nooks. Whilst the ship thus lay at anchor for a day or two our scientists went ashore to examine the country and its peculiarities, while the cartographers, in a motor boat, went back to the fjords which we had already passed, or farther ahead to places which we had not yet reached with the ship, and were picked up later with their material. We had feared that in many of the small fjords along the Blosseville coast, with their steep mountain sides, we should not be able to find safe anchorage; but everywhere we came to we found after shorter or longer search an anchorage where the ship could lie safe from ice. But I would advise future explorers of this stretch of coast to carry with them plenty of chain and a power winch, as hand power is not sufficient.

Our examination of the coast fell into two sharply divided sections, the first from Cape Dalton to a little west of Cape Ravn, and the second the Kangerdlugsuak territory, where the Watkins Expedition had found the rock formations which it was one of the chief aims of our expedition to study. In the first section there were not many differences in the general aspect of the country: steep, rather narrow and very rough basaltic masses separated the more or less deep fjords, at the head of which the inland ice was always to be seen, either issuing directly into the fjord, from which there was always a rather large production of icebergs, or else (but this more seldom, and really only found in D'Aunay Bay) big glaciers which were decidedly receding and had left large formations of moraine terminal.

The coasts of the fjords were rather steep, but in some of them small bights were common, and sheltered anchorage could always be found somewhere, either in one of these small bights with shallow water, or at the mouth of a strong stream, which forces away the drifting ice, and which carries so great a quantity of mud that the water of the fjord is coloured brown far into the sea. A characteristic of the coast seems to be the great lagoon formations. We knew from the Amdrup Expedition that such were to be found at Cape Dalton, but we were not prepared to find them farther down the coast to such an extent as was actually the case. The walls between the sea and the lagoon were formed by large rolled fragments, which seemed to indicate that at certain times of the year there must be violent breakers along the coast: in other words, that the pack-ice disappears in autumn, so that the strong waves from the Denmark Strait reach the land.

On this stretch of the coast, where the fringe of land is very narrow, and where the inland ice, practically speaking, comes to the head of every single fjord, very high mountains can be seen piercing the inland ice farther back, and whilst the coast consists only of basalt mountains, we found during a

couple of short journeys over the inland ice that the mountains farther inland consisted of plutonic rocks, mainly syenitic. These contain certain traces of minerals which, owing to the distance from the coast, will never be of practical value.

It proved that the fjords which we had an opportunity of mapping and examining were considerably deeper, and most of them more branched than we had had reason to believe from Amdrup's maps. And it was a pleasant surprise that the stretch of coast which we, after our journey in 1900, had considered as one of the most barren and desolate of the whole of the Greenland east coast, proved itself on closer examination more friendly than was anticipated. As soon as we had passed the green outer mountains, where plants could not find footing on the almost vertical sides of the mountains, or were greatly hampered in growth by the raw climate of the outer coast with its icy sea and cold fogs, the vegetation grew richer, both in growth and in number of species, of which several new were found. Our botanist, Mr. Tyge Böcher, found about on the middle of the Blosseville coast a sharp dividing line between the northerly and southerly flora.

Great valleys covered in vegetation, and the smooth mountain slopes, which are seen from Scoresby Sound towards the north, are not to be found on this part of the coast; big land mammals cannot secure sufficient food on the Blosseville coast and are therefore unknown south of Scoresby Sound. It is certain that the reindeer have never lived here in any great number, probably not at all, as we did not in a single spot find shed horns which, farther north, are very general and which are practically speaking indestructible. Nor did we find the smallest trace of musk-ox which, it can be taken for certain, cannot find sufficient food on the Blosseville coast, and Scoresby Sound is thus the southerly limit of this animal's range.

There are plenty of isolated places where hares could live, but sea and glacier hem in these territories, and make it difficult for the hare to spread over the country in any considerable number. We did not see any hares at all, but found such indisputable traces that we can say for certain that they do exist on the coast as far as D'Aunay Bay, whereas the marmot is found farther west. Bird life is however richer than was expected, and although we did not find fowling cliffs in the true meaning of the word, there were a fair number of birds in many places nesting on the steep, inaccessible mountain sides, or on the shores of the few lakes which we found, and on the large lagoons. Here the shy lory and eiderduck were found nesting. As a consequence of this scarcity of small land mammals and partly of birds, the fox cannot exist here in the same number as farther north, and although they are to be found, they are by no means general. This however cannot be said of the bear, of which we saw twenty-six on the Blosseville coast and in Kangerdlugsuak, and for the bear the conditions of existence are good, as seals seem to be plentiful. We saw them from time to time on the ice-floes, but especially in the fjords.

Insect life is comparatively rich and interesting, and our zoologist, Mr. Degerböl, who examined both the higher and the lower animal life on land and sea, found a similar definite dividing line between northerly and southerly fauna and insect life, as the botanist had found. From a scientific point of view it was probably one of the greatest results of the expedition that we had been

able so decidedly to define this dividing line, roughly speaking in the middle of the desolate Blosseville coast.

Navigation on the coast was in general at first not hindered to any extent by the pack-ice. Outside the big glaciers, which in two places reached to the coast and terminated in perpendicular glacier fronts, there was a great number of icebergs, but we passed them fairly easily. The current is very strong outside the steep headlands, and the several shoals we found off the coast caused numbers of icebergs to ground. On these the pack-ice was set by the current, sometimes causing difficulties.

Apart from the scientific work, we had also the more practical purpose to build houses for the Greenlanders, and we stopped consequently for a longer time than usual at Cape Daussy, where we anchored in a little open bay terminating in a valley entirely free of inland ice. As soon as the material, coal, and kerosene oil had been landed, the scientists, who gave the ship's crew a hand with this work, spread over the territory while the ship's crew erected the house. During these days there was a good opportunity for thorough scientific investigation of the territory before we continued along the coast. After we had passed the Sorte Bræ (black glacier) the ice-pack came in great masses near the land, and the coastal waters were filled with many grounded icebergs, between which the current was whirling masses of bigger or smaller ice-floes. We had the land quite close on starboard side, and were continually pressed nearer and nearer towards it by the ice-pack; at Cape Stephensen all progress was stopped by unbroken ice right up to the land. We tried to work the ship round the ice by keeping out to sea, but everywhere the pack was heavy, and icebergs came sailing down with the current to ground on the edge of a large shoal covered by an immense sheet of unbroken ice.

After four days' fruitless work trying to find a way through the ice towards the west, we had to give up and go into the fjord east of Cape Ravn to wait for the break up of the ice; and though we were always waiting for an opportunity to get away, occasion was given for a geological journey over the inland ice as far as the Wiedemann Mountains[1]—an enormous mountain range stretching far to the westwards. The enforced delay was from a scientific point of view of great importance, as it was in this part of the coast that we found the dividing line between the fauna and flora of the north and south, and also the previously mentioned plutonic rocks amongst which syenite predominated. After eight days the unbroken mass of ice had been so affected by the weather and current that we could hope to continue our journey. The weather was however bad, with high wind and sleet, so we could not, as we had hoped, map the coast or the fjords farther towards the west, and the ice also prevented us from reaching the coast.

We had for a long time had the impression that the ice on land had diminished considerably since the coast was visited for the first time in 1900, as many of the small local glaciers which we had then seen had now wholly or partly disappeared, a definite proof that the climate had altered and had become milder. This impression was confirmed very strongly when we passed the

[1] The mountains for which this name is here proposed seem to be the mountains seen from the air by Mr. Watkins and shown in a photograph by him published in the *Journal* for July 1932, facing page 7.

coast between Cape Rink and Cape Normann, where, in the bay between the two promontories, thirty-two years ago there were seen large glaciers, which had now disappeared, and the land at the head of the bay was practically bare of snow.

Round about Cape Nansen the pack-ice diminished considerably, and we tried to get into the fjord west of Cape J. A. D. Jensen. In the mouth there was however quite a lot of ice, and the swell, which in the open had not been too noticeable, was rather severe here and put the ice in so violent a motion that we were unable to force a way through the ice-belt, and lost control over the vessel. The current was setting hard against the land, and for a while it looked rather bad for our ship, which, by ice, current, and swell, had been forced quite near land under the mighty vertical basaltic mass of Cape J. A. D. Jensen. However, we succeeded at last in getting out in more open water and kept the ship going for twenty-four hours, hoping to strike better weather. But as this did not come, we had to continue, and after some difficulties succeeded in anchoring in Mikis Fjord, which proved to be considerably larger than shown on the map and the most friendly fjord in which we had yet been.

We landed a house here also, so there was a good opportunity for scientific work in the fjord, where we found a rather large Eskimo settlement, very old and entirely in ruins, with a number of graves, meat depots, and fox traps. The ruined huts were dug out, and we found a number of implements amongst the ruins, many of which were well preserved and of archaeological value. To judge from the implements we found this coast seems to have been inhabited about 1400–1500.

We were now so near Kangerdlugsuak that our English geologist, Mr. L. Wager, could leave the ship and commence his chief work, the examination of the Nepheline syenitic formations found by him as member of the Watkins Expedition, which investigations Mr. Wager carried out with great energy and considerable skill. He established the fact that the deposits of Nepheline syenite were larger than expected from the provisional investigations made formerly by the Watkins Expedition, and that in reality it was found along a great stretch of the west coast of the large Kangerdlugsuak fjord, particularly round about the bottom of the Amdrup Fjord. But although he could prove traces of different minerals in the Nepheline syenite, they were found so comparatively far inland and in such inaccessible places, that it is more than doubtful if they will ever prove of economical value. While the geologists worked in Kangerdlugsuak, followed by the cartographers of the expedition under the leadership of the Englishman Mr. Michael Spender, whose main work also fell at this locality, the remainder of the expedition continued its scientific work in Mikis Fjord and brought home considerable collections from there.

In the beginning of August we sailed to Kangerdlugsuak where, on the east side of the fjord, and in the sheltered, long and narrow Uttental Sound we found an excellent anchorage, where the ship could lie well protected against drifting ice and swell and, as it later proved, also against storm. This was of great importance to us, as in this fjord there was much to do for the scientists as well as the crew, who apart from helping the scientists, and taking them where they wished to go, would be very busy building houses a fair distance

South-west side of Kangerdlugsuak

North side of Watkins Fjord

Mountains in Kangerdlugsuak

from the anchorage, in consequence of which the ship would have to lie practically without any one to look after it.

In Mikis Fjord we saw the first sign that the basalt mountains of the coast began to give place to other kinds of rocks, and the head of the fjord consisted of gabbro and gneiss, which in Kangerdlugsuak stretched right out to the outer coast, although a certain amount of basalt was found farther in towards the head of the fjord. This new geological structure of the country caused an entirely changed character in its aspect. Instead of the previously so rough and sombre basalt mountains, we now found others, which had been worn smooth by the ice and were rather highly coloured—the yellow-red sides of the mountains being interspersed with broad dark basaltic dykes which, in conjunction with the curious forms of the mountains, gave the country a more lively and more friendly appearance than farther towards the east. It was however only at a distance that we had this impression, for as soon as we went ashore we were surprised to find much less luxurious vegetation than farther east, probably because the harder kinds of rocks of this locality not only crumble less easily than the basalt, but also do not afford the same conditions for soil building.

To this has to be added that the climate in Kangerdlugsuak, to judge from the vegetation, must be drier than farther east or south, and these two factors are mainly responsible for the sparse vegetation which is to be found in the fjord. It was really only in the hollows of the mountain sides, where the finer particles of soil could find a resting-place and retain moisture, that we saw a little vegetation. Otherwise the greater part of the country was practically entirely bare, and this was a deep disappointment to us, as we had expected to find better conditions here where the fjord cuts so far into the land. But the animal life was a pleasant surprise, for it was richer than farther east, probably richer than I have seen it anywhere else on the east coast of Greenland. Here, for the first time, we encountered walrus along the outer coast, as well as in the fjord itself. We also saw a number of fjord seals and narwhal, while the bearded seal, which is of such great value to the Greenlanders, was fairly general. But we were especially surprised to find the Greenland seal in rather large herds, mostly in the sheltered outer districts of the fjord, and we were hardly out once in our motor boat without seeing several herds of this particular kind of seal. Once we counted from the ship at the same time three herds, each containing from fifty to one hundred animals. To judge from the many bones of Greenland seal found in the kitchen-middens, which were found outside the ruined Eskimo huts, both in Kangerdlugsuak and in Mikis Fjord, the population must previously have lived, to a great extent, on the Greenland seal, and we can thus conclude that it is not a mere accident that we came upon them here now.

There was also a number of bears in Kangerdlugsuak, and we found bear paths, which the animals had trodden during their wanderings along the passages between the different fjords in the territory. Foxes were also rather common in the fjord and bird life was fairly rich.

Although the fjord was bleak, with great glaciers everywhere and also filled with a mass of icebergs, excellent living and hunting places could be found in this district for the Greenlanders, especially where their forefathers had once

settled. With the Amdrup Expedition we had found the remains of a fairly extensive Eskimo settlement on the outer side of the Skaergaards Peninsula, but on the numerous small islands behind this there were many until now unknown settlements, and once upon a time rather a large number of Eskimos must have been living in this district. Both in the huts and especially in the graves, we came across many archaeological finds of importance, but a catastrophe or some other tragedy must have overcome the Eskimos here as well as in the Mikis Fjord, for in several huts we found a number of skeletons, and it seemed as if the Eskimos had met with a sudden death. The hunting in Kangerdlugsuak is however so good that the Greenlanders can now run no risk. On the contrary, it is our impression that they will find better conditions here for living than in their home place, Angmagssalik.

In order to find out whether there was sufficient food in the sea for this large number of seal, we examined the lower fauna in the ocean and found it surprisingly rich, and found at the same time that veritable forests of seaweed existed. It was especially in the outer districts of the fjord that we undertook these investigations: farther into the fjord we did not have such good opportunity, as the depth and the strong current hindered our work there. But some investigations were made, and they proved that all along towards the head of the great fjord there was plenty of food for the sea animals.

When we had finished the work in the outer districts of the fjord which could be done from and with the ship, we proceeded towards the head of Kangerdlugsuak, which was filled with exceedingly large icebergs that drifted outwards with the strong current, and almost blocked the passage in the narrowest part of the fjord, where there seems to be a deep-lying reef between Watkins Fjord on the eastern side, and Amdrup Fjord on the western side, upon which the bigger icebergs grounded.

The innermost part of Kangerdlugsuak widened out into a large basin, more than 600 metres deep, surrounded by high, very rugged but picturesque and brightly coloured mountains. Farthest towards the north-west, the inland ice forms a mighty glacier, probably the largest in Greenland. This is moving rapidly and the glacier-tongue stretches some kilometres out into the fjord. At a distance it looks as if the tongue of the glacier forms a continuation of the inland ice, but when examined more closely, it is found that it is broken off and split up into enormous icebergs, separated from each other by long but very narrow channels. These mighty icebergs, which consist of curiously broken ice, ground outside the mouth of the fjord in very great numbers, and appear as great floating islands, extremely rugged and of very uneven surface.

It was impossible to find an anchorage towards the head of the fjord, as the water was too deep and the current too strong, so our investigations from the ship had to be confined to the least possible, as we should have been in a very unfortunate situation if we had met with one of the very violent storms which seem to harass this district in late summer. We therefore had to confine ourselves to landing our scientists at different likely spots, whilst the ship was kept going near land, but it was soon apparent that only the cartographers and the geologists could find work of sufficient interest here as the inland ice everywhere lay behind comparatively narrow and very steep stretches of coast mountains, so that the greater land stretches, which we fondly had expected

Uttental Sound, Kangerdlugsuak

Head of Kangerdlugsuak

House built by Captain Mikkelsen in Lake Fjord for Rymill, Chapman, and Riley

Lakes in Lake Fjord

to find on both sides of the fjord, did not exist. As a consequence of this, the flora inland was much poorer than near the mouth of the fjord, and the land fauna absolutely insignificant. Only in the sea there was plenty of animal life: the fjord seal was very common and the Greenland seal was also seen here as well as some narwhal.

When the cartographers had finished their work at the head of the fjord and the scientists were of the opinion that they could gain nothing particular from a prolonged stay in this desolate tract, we again returned towards the mouth of Kangerdlugsuak. And as we did not think we could gain much by keeping the ship in the fjord, we left the cartographers and the geologists, each group consisting of three men with a motor boat, and went back to Mikis Fjord, from the head of which a third group wandered inland to reach some great lakes, which we had previously seen from the mountain tops behind the fjord. These lakes were about 300 metres above sea-level, but contrary to expectation the land here was, if possible, still more desolate and bare of vegetation than in Kangerdlugsuak, and only in a few spots where the snow remained longer at spring time and thus moistened the soil a little vegetation was to be found.

From the neighbourhood of the lakes we had a splendid view of the surrounding land, which was practically covered by ice, pierced by high mountain ridges, and in this desolate and barren country the only trace of life was a newly trodden bear track, a loom, and a small variety of salmon. It is curious that a fish can live in lakes at this altitude, as the only possible outlet is under the glacier towards the bottom of Watkins Fjord.

We had hoped to have an opportunity of examining and mapping the fjord to the east of Mikis Fjord when our colleagues came back, after having finished their work in Kangerdlugsuak, but their work, and the journey back to the ship, was much delayed by exceptionally bad weather lasting several days, with heavy rain and violent swell along the outer coast. After an exceptionally good summer the autumn started early and came with unusual violence. It was however not so cold as usual; on the contrary the temperature reached 14½° C. on August 30, but the storm and rain were so violent that during the last twenty-four hours of the downpour, when it did not even rain as heavily as on previous days, we measured no less than 6·4 cm. of rain.

We tried to reach the fjord to the east of us during a short break in the weather, but had to turn back, partly because it again began to rain and storm, but chiefly because a reef apparently stretched right across the fjord, and a heavy ground swell was running over it. On September 1 the weather at last seemed to improve, and we left this part of the coast in order to go southward. It was our intention to make an attempt to land at Nualik in order to erect a traveller's hut for the Greenlanders and to leave provisions for them there, but although it was calm when we reached the landing-place, the swell was so heavy that we had to give up the attempt of making a call as landing was impossible.

The Greenlanders had however built themselves huts at Nualik in 1928, so it was not of great importance that we had to give up the plan of landing, and we consequently continued to Lake Fjord, which we reached late in the evening of September 2. It had been our intention to land a house between Angmagssalik and Nualik to facilitate the Greenlanders' travelling to and from Kangerd-

lugsuak; and before we left Denmark we had promised Watkins to build this house in Lake Fjord, so that he and his men could use it during their winter's stay. However, while farther north we had received information through the wireless that this young and enterprising explorer had been drowned whilst seal hunting. This sad news of his far too early death made a great impression on us, and it was with gloomy feelings that in the gathering darkness we felt our way into the fjord which had been the scene of this lamentable tragedy.

The bad weather we had struck farther towards north had apparently prevented Watkins's comrades from being at their camp on our arrival, for the tent was dark and empty. The next morning we began to land building materials and to erect the house. Later in the day the three survivors of the Watkins Expedition appeared, and as they had only a little provision—for Watkins had reckoned on being able to supply enough meat for his expedition by hunting, we left sufficient of our expedition's store to see the three men through the winter, thereby enabling them to complete the scientific work they had undertaken.

After a few days in Lake Fjord we left for Angmagssalik, met with no ice difficulties whatsoever, and anchored at the settlement in the afternoon of September 4.

As will appear from the above, luck smiled on us to a great extent, and we fully achieved the practical and scientific aims of the expedition, namely, to map a large part of the coast after the most modern methods, as well as to make a thorough investigation of the geological, botanical, and zoological conditions prevailing on the Blosseville coast and at Kangergluksuak. Further, we had created the possibility of this stretch of coast again being peopled by the successors of the tribe, which had long since died out, but traces of which were so numerable in the Kangerdlugsuak territory—and we had linked together the older settlement of Angmagssalik and the new one in Scoresby Sound.

APPENDIX I.—NOTE ON THE NAMES "BASE FJORD" AND "LAKE FJORD" OF THE WATKINS EXPEDITION

When Captain Holm was in the country in 1884–85 the Base Fjord was known to the Eskimo as SUPORTUP KANGERDLUA. The name means "The Windy Fjord," which seems to cover the conditions found by the Watkins Expedition.

Lake Fjord has the Eskimo name TUGTILIK, which is to be found on the map of the coast from Angmagssalik to Kangerdlugsuak drawn for Gustav Holm by the Eskimo. The name Tugtilik means "the place which had reindeer (or caribou)," and is the only place on the whole of the East Greenland coast where the Eskimo have affixed the name of reindeer. The name ought not to disappear from modern maps. It may be added that the Eskimo knew all about the lakes found at the head of the fjord. They are shown in *Medd. o. Grönland*, vol. ix, Plate XV and Plate XVII.

APPENDIX II.—SURVEY

By MICHAEL SPENDER

Stephenson ("Kangerdlugsuak and Mount Forel," *Geogr. J.*, vol. 80, July 1932) has already commented on the excellence of Amdrup's map of the coast-line from Angmagssalik to Cape Dalton. Whereas Stephenson undertook the revision of the stretch south of Kangerdlugsuak, our first problem was the

revision of the northern section, from Kangerdlugsuak to Cape Dalton. Our second problem was the revision of Stephenson's and Courtauld's own survey of Kangerdlugsuak. A proof of Stephenson's paper and a conversation with Courtauld were extremely valuable to me in forming plans for our scheme of work. I was particularly interested in estimating the value of the range-finder technique, which was first used by the English surveyors and was to them essential in rapid coastal survey. The method, originally suggested by Professor Debenham, was to plot the directions of rays on a plane-table and measure the distances of the respective points by means of a Barr and Stroud 30-inch artillery range-finder.

I attempted to obtain such an instrument, but was not successful. But had it been obtainable, I can remember only one occasion, and that during the survey of the small and tortuous Mikis Fjord, when I should have used it. In general the distances to be measured are too great to be secured with any accuracy from a 1-metre base. In consequence Stephenson's sketch of Kangerdlugsuak is more distorted than would have been the case had he made a normal plane-table triangulation with a telescopic alidade. Nevertheless, following Professor Debenham's original idea, we used a range-finder technique. Our base was however 200 metres or more long. It is impossible to observe simultaneously from the ends of such a base. But if the angles are taken to carefully selected points by means of a precise theodolite such as the Wild Universal, the distance may be calculated from the small angle subtended by the base at the distant point. This is the same method as that of the range-finder, but has the disadvantage that it is not automatic.

Since the distances must be calculated, a modification of the technique must be made to allow for the delay. Our method was, where possible, to fill in by plane-tabling between points determined by the base method. Each unit of such a survey would be fixed astronomically and the whole worked up later into a continuous map. In some cases it was impossible to wait for the range-finder points. Then I had to go ahead with the Wild telescopic alidade and plane-table equipment while my assistant determined the scale of the resultant sheet and made the astronomical observations. At other times the filling in had to be done from the ship, with sextant and station-pointer. In this way we mapped the northern half of the stretch from Kangerdlugsuak to Cape Dalton. Continuous storm prevented any attempt to map the southern portion. This southern portion is a steep inaccessible coast which will be a very tough problem for some future surveyor.

In Kangerdlugsuak we made a photogrammetric survey from ground-stations. By means of the base-method we built up a rigid triangulation over Kangerdlugsuak and Mikis Fjord. The detail was filled in from the photographic stations, plotting being done on the Aerokartograf at the Geodaetisk Institut in Copenhagen. The working up of the sheets was much helped by the air-photographs taken by Watkins in 1930 and kindly placed by him at our disposal. The adoption of the photogrammetric method allowed us to obtain from eleven days' field work a contoured map of high precision of a fjord 72 kilometres long together with the neighbouring mountains, the whole area amounting to 2600 square kilometres.

We were disappointed in not being able to get a precise determination of the position of the New Mountains described by Stephenson (*loc cit.*, p. 5). The position and height of a single peak was however roughly fixed from a station in Kangerdlugsuak. This showed the range to be indubitably above 3000 metres high; though probably Stephenson's estimate of 12,000 feet is too great. The approximate position of the range is in lat. 68° 45′ N., and long. 29° 44′ W.

APPENDIX III—BOTANY

By TYGE WITTROCK BÖCHER

The collections made in the course of our expedition consisted both of phanerogams and cryptogams. The total number of species of phanerogams and vascular cryptogams collected amounted to somewhat over 150, the total number of specimens being about eight hundred. The only cryptogams which up to the present have been subjected to examination are the few marine algae which were dredged at Kangerdlugsuak, the examination having been undertaken by Mr. Harold Wager, who found thirty species.

Ostenfeld in 1926 divided Greenland into districts and mentions 123 species as occurring in the district between lat. 66° 20′ and 70° N.; but eight of these species have never been found in the district. Ostenfeld however considered himself justified in including these species, because they are distributed in the adjoining districts. Thus until 1932 115 species were on record from this district, and the collections made by our expedition increased the number by thirty-five species, so as to make a total of 150. In the case of seventeen species the northern limits were moved from Angmagssalik to between lat. 68° and 68° 40′; the number of southern limits identified in the area between Cape Dalton and lat. 68° 40′ amounted to thirteen.

When investigating the "falling off" of the vegetation (*Florengefälle*[1]) in a northerly and a southerly direction, and adding these figures, it appears that this falling off—regarding only the coastal zone—is particularly large in the area between lat. 68° 30′ and 68° 50′, inasmuch as it here amounts to 18 per cent. of the total flora of the east coast. The high figure is due to the fact that a great number of southerly species north of this line are only able to live in the inner and warmer parts of Scoresby Sound, and that a number of northerly species are confined to the dry mountains of the interior.

The composition of the flora north and south of lat. 68° 30′–50′ shows that the northerly and southerly contingents in the northern coastal zone correspond entirely with the figures from Scoresby Sound, whereas the corresponding figures in the southern coastal zone agree with the figures from Angmagssalik.

The communities of plants are distributed in relation to the line lat. 68° 30′–50′, in such a manner that to the north of it there is heath consisting of *Cassiope tetragona*, whereas to the south the association is *Empetrum—Vaccinium uliginosum*. To the south luxuriant herb fields occur with a very large number of species, and near lat. 68° 10′ willow copses extend towards the sea. A characteristic southern element is an association consisting of a high *Alchemilla glomerulans* growth, and a sub-vegetation of *Thalictrum alpinum* and *Pirola minor*, whereas the polygon field communities are characteristic of the northern area.

Thus, on the strength of these floristic and ecological results, it seems possible to establish a line of demarcation between the two elements of vegetation, viz. the southern and northern element. Whereas the tree limit occurs at about the 10° C. July isotherm (inner fjords in Greenland), the next line at the 4°–5° C. July isotherm corresponds with the limit, which also occurs in the high mountains of Scandinavia between a *Regio alpina* I and II (Thore Friis, 1917).

From the point of view of the climate, the limit coincides with the line of demarcation between the dry cold central-arctic climatic area towards the north, and the warmer, far moister North Atlantic polar area towards the south. The picture presented in 1932 by the ice conditions and consequently also by the

[1] K. R. Kupffer: 'Grundzüge der Pflanzengeographie des ostbaltischen Gebietes.' Riga, 1925.

climate along this coast corresponded very well with the line of demarcation being about Cape Ravn (lat. 68° 31′).

Kangerdlugsuak (including Mikis Fjord) showed an interesting difference between an inland flora and a coastal flora. The investigation of this fjord area is based upon finds of plants from fifteen localities. It appeared that the coast land had eighteen species which only occurred there, whereas there were thirteen characteristic of the inland. Only in one inland locality was there a fairly large southerly contingent; otherwise in this area it was the coastal zone which had the largest contingent of southerly elements, and the inland which had the high-arctic plants. This difference in the flora is in all probability principally caused by the greater drought prevailing in the interior. There is however also a geological difference between the inland and the coast zone, Mikis Fjord and Skaergaard Peninsula constituting a basalt-gabbro area, which yields better conditions for the vegetation than the gneiss and nepheline-syenite areas of the interior. The number of phanerogams identified in Kangerdlugsuak amounted to 100 species, that of marine algae to about thirty. Particularly in Uttental Sound there is a luxuriant growth of algae, which undoubtedly constitutes the basis of the rich animal life in this sound.

The expedition throughout its course examined the communities of plants, chiefly by means of the Raunkiaer circling method, but also by a thorough investigation of occasional square metres of vegetation. The total number of circling investigations was seventy, while the number of squares examined amounted to fifteen. On the strength of these investigations it is possible to distinguish between the following important communities of plants:

A. *Communities with two assimilation layers*

1. *Willow copse.* The willow copses are frequently xerophilous, with a sub-vegetation of *Empetrum* and *Vaccinium uliginosum;* but there were also copses with a more fertile soil and a sub-vegetation consisting of herbs.
2. *Alchemilla glomerulans field*, with a sub-vegetation consisting of herbs.

B. *One-layer communities*

1. *Herb field.* North of lat. 68° 30′–50′ it was comparatively poor in species; to the south it was, on the other hand, very rich in species (thirty-five species in twenty-five "circles"). Contains a great number of sub-associations.
2. *Grass field associations* (particularly the *Carex rigida* association).
3. *The heath series associations*
   (*a*) *Cassiope tetragona* heath.
   (*b*) *Cassiope tetragona, Empetrum, Vaccinium uliginisum* heath.
   (*c*) Dry *Empetrum, Vaccinium uliginosum* heath. Rich in lichens.
   (*d*) Moist *Empetrum, Vaccinium uliginosum* heath. Rich in herbs.
   (*e*) Moist *Empetrum, Vaccinium uliginosum*, intermixed with *Phyllodoce coerulea, Cassiope hypnoides* and others.
   (*f*) Luxuriant, moist heath, rich in species of *Empetrum, Vaccinium, Diapensia, Rhododendron*, intermixed with *Scirpus caespitosus, Pinguicula, Tofieldia palustris* association.
4. *Snow-cover associations* (*Schneeboden Gesellschaften*). According to the shorter or longer duration of the snow-cover it is possible to distinguish between several associations. The most important of these is the *Carex rigida—Salix herbacea—Polygonum viviparum* association.
5. *Moor.* (1) Moss-moor, (2) tuft-moor (*Carex rigida—Salix herbacea*).
6. *Sphagnum swamp* (*Carex rariflora—Polygonum—Salix herbacea* association).
7. *Freshwater lake associations.*

8. *Riverbank associations.*
9. *Strand meadow, strand flora.*
10. A special position is occupied by *Warming's fell field;* it is not a natural growth, but a number of rather different associations, which are more particularly connected with the heath series.

Oxyria digyna is frequently attacked by *Ustilago vinosa* (a parasite micromycele) which powdered our footgear with a purple spore powder when stepping in the plants. This was particularly pronounced in and around the Eskimo house ruins in Mikis Fjord and Kangerdlugsuak. It is very probable that the Eskimos used the purple powder as a dyestuff, as in the course of our excavations we found a small sealskin bag containing the same purple powder.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: The Blosseville coast of East Greenland, which extends from Scoresby Sound on the north as far south as Angmagssalik, takes its name from a French naval officer who, just one hundred years ago, sighted that part of the coast and the mountains behind it. He returned to Iceland to make his report, and went again to East Greenland, only to disappear. Presumably he and his vessel were crushed in the ice; and so in fact he never landed. It was a graceful compliment that his memory and that of his crew was perpetuated by giving his name to that part of the coast of Greenland.

Captain Mikkelsen, who is to lecture to us on that coast, is indeed a veteran in Arctic exploration. Since 1900, when he was a member of Captain Amdrup's expedition to South-east Greenland, he has spent, in all, a great part of thirty-two years afloat and on shore in Arctic waters. He is an old friend of this Society and lectured to us on his expedition of 1909–12 to North-east Greenland in January 1913. We published a paper by him in the *Journal* for November 1907 on his expedition of 1906–08 to the Beaufort Sea, and there have been many notes recording his activities.

I said Captain Mikkelsen was an old friend of this Society, and on one occasion during his recent explorations and travels, an occasion which I will refer to later in the evening, he did indeed behave as a very true friend. It is interesting to us also that he had with him on the expedition on which he is to lecture three of our countrymen: the two brothers Wager, one of whom, as you know, has gone to India on the Mount Everest Expedition, and Mr. Michael Spender.

Captain Mikkelsen then read the paper printed above, and a discussion followed.

The PRESIDENT: We pride ourselves in this Society that after a lecture we can call on some one who has been at the place talked about at some other time and seen it from some other angle, but to-night I can produce no one. Except Captain Mikkelsen, his friend Captain Amdrup, and the two seamen who were with them, no one has been to that part of the coast. Many have been farther south and some farther north. I had hoped that Dr. Longstaff would have been here, for he is one who has been farther north and knows Captain Mikkelsen very well. We however have with us Mr. Scott, and I will ask him to say a word or two.

Mr. J. M. SCOTT: I am afraid I have not been within several hundred miles of the Blosseville coast, so I have no very good claim to speak about it. But I know you will agree with me from Captain Mikkelsen's lecture that he is undoubtedly a great traveller, and the proof of a great traveller is that he is a man ready to help other travellers. I had to go and buy dogs and was on board ship with fifty of them and about a ton of fish which had been fresh when we started. I became very unpopular, and had to be put off the boat at the Faeroe Islands.

The only person who would have me was Captain Mikkelsen, and with him I stayed six weeks. He fed me on beer and whale-meat, and the dogs on whale-meat without the beer. At the end of that time the whole team were in such good condition that they could go straight to Greenland and start work at once. That is an instance of the real traveller who is willing to help others. That help made an immense difference to our expedition.

The PRESIDENT: May I, Captain Mikkelsen, very warmly thank you, on behalf of the Society, for the reference you made to Gino Watkins. When he was drowned, His Excellency, the Danish Minister, wrote to me, "All Denmark mourns," and I can assure you that those words and what you have said to-night are a comfort to us in what was a very great loss to the Royal Geographical Society and to this country.

I said an hour or more ago—it does not seem so long for the time has passed with great rapidity—that on one occasion last year Captain Mikkelsen showed himself a very true friend. He has made very little of it; in fact, he has hardly mentioned it. He had arranged, as you know, with Gino Watkins to put a hut up for him at Lake Fjord. Then he heard of Gino's death. When he arrived at Lake Fjord he found that the three other members of the expedition—Chapman, Riley, and Rymill—had gone south. He started at once to put up the hut with his own men and his own carpenters. When the members of the expedition came in next day he found them very short of provisions. No doubt they had depended mostly on Gino Watkins to hunt. In any case, they were short. Without the slightest hesitation, Captain Mikkelsen, with the mind of a great traveller and all that generosity of heart which you will have realized from his lecture that he possesses, gave them everything that they required—flour, stores, everything that three men could possibly want to keep them through the long Arctic winter. I am very glad to be able to say to Your Excellency, as well as to Captain Mikkelsen, and I hope it will be well known, that we do regard that as an act of friendship which we appreciate very deeply indeed.

Captain Mikkelsen has shown us what can be made of a very barren country and how it may be made, if not fertile, at least habitable. You will have noticed, I am sure, as I have, the underlying spirit of all Captain Mikkelsen's journeys and travels. I have had particular opportunities of realizing it, for he gave me the privilege of talking to me with Mr. Scott and Mr. Augustine Courtauld on Friday for an hour; underlying everything he has done in the way of travel and the hardships he has suffered has been the wish to do what he could for the natives of the country to which he went, and for the benefit of the human race in these very desolate places; the regret that people who had formerly lived there in considerable numbers now do so no longer; and the desire to see them again prosperous and living in comfort.

It was extraordinarily pleasant, Captain Mikkelsen, to hear you speak in such terms of our three young countrymen who went with you. I do not know whether ties you have prevent you from going again to those coasts, but if you do go again I can assure you that any young Englishman will consider it an honour to go with you and a very great privilege to be able to say afterwards that he sailed with Captain Mikkelsen. You have given us a most delightful evening. The hour is a little later than our evenings generally end here, but as you will have seen no one person has moved, which is an indication that the lecture has not been a moment too long. I ask you to accept, on behalf of this audience, and of the Royal Geographical Society, our warm thanks for the admirable work which you and many others, your companions, have done in the many years of your travels, the great friendship you have shown to our own countrymen, and the charming way in which you have lectured to-night.

THE PHYSIOGRAPHY OF SOUTH HAVEN PENINSULA, STUDLAND HEATH, DORSET

Being No. I of a series of Contributions towards a Survey of the Plants and Animals of South Haven Peninsula, to be published in various journals

A paper read at the Afternoon Meeting of the Society on 13 March 1933, by

C. DIVER

THE name Studland Heath has been attached to an area of relatively high heathland that lies to the north of Studland village. Based on the Heath proper is a low-lying peninsula that runs northward to South Haven Point and forms the southern of the two arms guarding the entrance to Poole Harbour. This peninsula, the north-eastern shore of which is known locally as Shell Bay, is thus bounded on three sides by tidal water; and only at the southern end is a clear-cut natural boundary wanting. A satisfactory artificial boundary can however be drawn; and with the area so enclosed, which for the lack of a better name will be referred to as South Haven Peninsula, the present survey is concerned.

This area, which has for many years attracted the attention of naturalists because of the interesting elements in its flora and fauna, is well suited for ecological work. Within a length of 2 miles (the average width is about 1200 yards) there is a number of distinct communities in various stages of development and competition; and, so far, there has been little interference by man.

During an investigation of the grasshopper species[1] reference was made to the geological survey carried out by Mr. Clement Reid in 1894. The comparison of this map with the 1925 issue of the Ordnance Survey revealed that rapid changes had been taking place in recent years. It therefore seemed worth while to try and trace the history of the various physical features and plant communities by the use of older maps and charts. Through the courtesy of the officials at the Admiralty, the British Museum, the Geological Survey, the Ordnance Survey, and the Royal Geographical Society, I have been able to examine not only a number of published maps and charts, but also field sheets and original documents. A list of the maps referred to appears at the end of this paper.

Before the beginning of the eighteenth century detailed mapping of land features, other than those of direct importance to landsman or mariner, is hardly to be expected; but the coastal outline of this peninsula can be satisfactorily followed through three and a half centuries. The geological evidence suggests that it has existed in some form for a long time, for on the western side there is a considerable area of raised land, now some 20 to 30 feet above sea-level, where Bagshot beds of Eocene age are exposed.

Existing Conditions on South Haven Peninsula

The outline and fixed features of the folding map have been drawn from the Ordnance Survey sheets as revised to 1924. No attempt has been made to

[1] C. Diver and P. Diver, "Contributions towards a Survey of the Plants and Animals of South Haven Peninsula, Studland Heath, Dorset. III. Orthoptera." *J. Animal Ecology*, 1933 (in press).

re-survey the area for changes since that date, but the new road and some changes in the distribution of water, marsh, and trees have been sketched in. Several of the coastal features have recognized names that appear on large-scale maps; but for the remainder, and particularly those inland, it has been necessary to invent names. The areas thus denominated have been determined after consultation with Mr. R. D'O. Good in the light of his plant survey.[1] Since plants must inevitably be the primary link in any food-chain, the distribution of their communities affords the best basis on which to found these minor divisions.

The boundary selected to delimit South Haven Peninsula from the rest of Studland Heath runs as follows: the natural western boundary of the harbour shore is continued down Brand's Creek as far as Brand's Ford, it then runs east along the old track till this meets the road; the boundary then turns southward along this road (which practically follows the line of the track marked on the present O.S. maps) until it again turns due east, just north of Knoll House, along a track running to the shore of Studland Bay. This line, which has the practical merit of being easily followed in the field, does in fact separate the low-lying land from the more uniform heather community of the higher parts of Studland Heath.

The area may conveniently be described from east to west. Along the whole sea coast there is a wide beach of sand[2] backed by a ridge of low marram-covered dunes (First Ridge), on the landward side of which some heather is already established. Behind this ridge in the northern half is a strip of saltings (Saltings Strip[3]); the characteristic plant is the rush, *Juncus maritimus*. The main strip is separated from the north-east coast by low hillocks of recently blown sand, and at its southern end runs into Eastern Lake (Plate 4). Just south of Eastern Lake, and running west, is a narrow tongue of sand (only a foot or so above the level of the lake) heather-covered at first and then bearing a low belt of mixed trees. A barrier is so formed between the water and marsh of the lake and East Marsh, which runs westwards to the margin of Little Sea, Central, and southwards for some 300 yards in the form of an inverted L. Except in a dry year, there is enough standing water in this marsh to make it a breeding ground for dragonflies (e.g. *Libellula quadrimaculata*). As the marsh dies out it is replaced by heath (Southern Heath) in which there is a number of shallow damp grassy depressions. These marshy spots reach their full expression towards the southern boundary as Pipley Pools.

Along the north-east coast, west of Saltings Strip, are some marram-covered dunes (Shell Bay Dunes) built up during the recent erosion of Shell Bay. These dunes are connected with the north end of an older ridge (Second Ridge) which reaches some 30 feet at its highest, and then steadily drops away southward until it runs out at the junction of Saltings Strip with Central Marsh. Deep well-grown heather (*Calluna*) covers most of Second Ridge.

[1] "Contributions towards a Survey of the Plants and Animals of South Haven Peninsula, Studland Heath, Dorset. II. Flowering Plants and Ferns." (In preparation.)

[2] At its widest opposite Eastern Lake, where about 120 yards separate the edge of the dunes from the high-water mark of ordinary tides.

[3] During the winter 1932–33 a shallow drainage ditch was cut running the length of the strip from Eastern Lake to Shell Bay. In March 1933 quite a rapid stream of water was passing down this ditch.

West of Shell Bay Dunes, and divided from them by a grassy strip (Northern Dune Marsh), lie some short ridges (Northern Dunes) which run out by Northern Enclosure. On these, short grass, gorse (*Ulex*), ragwort (*Senecio Jacobaea*), etc., replace the marram (*Psamma*).

The lake-marsh system completely separates Second Ridge from the corresponding formation in the southern half of the area. Here Inner Ridge is a fork springing northward from First Ridge, and gently curving inland until it dies out near the junction of East Marsh and Little Sea. Landward of this, in the middle of Southern Heath, are two isolated sandhills marram-capped (Lone Dunes, Plate 3).

From the northern shore of Little Sea, Central, a drainage stream has been cut to carry the excess water out into the sea near South Haven Point. In the south the stream is flanked by a wide belt of swamp which northwards gives way to less well-defined marsh[1] with low heather-covered hillocks rising here and there. Several small clumps of sallow and birch (*Salix*, *Betula*) in various stages of development occur in this area. These conditions persist till the stream enters Northern Enclosure. Within the enclosure, which is surrounded by grassy banks, the predominant feature is beds of rushes, but grassy areas and patches of bog myrtle, heather, and gorse are present. The rush saltings continue beyond the north bank of the enclosure (South Haven Saltings) until they are swamped by the beach sand.

South Haven Point, in so far as it has not been interfered with by the construction of the road and floating bridge and the erection of wooden bungalows, is mainly a grassy area (South Haven Flats) with gorse, ragwort, etc., but it has considerable botanical interest. From just behind this, and based on the harbour shore, rises another dune system (Third Ridge) which at first runs between the harbour shore and the road, then, crossing the road, divides Central Marsh from One-acre Pool, New Pool, and the northern arm of Little Sea. There is no corresponding feature in the southern half of the area.

With the exception of Northern Enclosure and some acres round it which are marked as alluvium and of various patches of peat, all the ground so far described is shown on the geological survey as blown sand.

The central feature of South Haven Peninsula is the lake system. In the north lies One-acre Pool, an isolated piece of water with no affluent or effluent streams. The water varies around a depth of about 2 feet and supports a dense population of marsh St. Johnswort and buckbean (*Hypericum elodes*, *Menyanthes*) (Plate 5). The pool is extending southward into its elongate marsh. New Pool is apparently a very recent development of open water in another isolated marsh. The water is no deeper, perhaps a little shallower, than in One-acre Pool. Though a good growth of marsh St. Johnswort is developing, the vegetational appearance of the two pools differs considerably because of the paucity of species in the latter. Little Sea, including Western Arm, covers over 70 acres; though generally shallow, the water in parts probably reaches a depth at least as great as 6 feet. The lake is permanently open water except for certain bounding areas in which reeds (*Phragmites*) are conspicuous. The only effluent is the artificial drainage stream already referred to. There is no defined

[1] Grass, bog myrtle, and rushes (*Molinia*, *Myrica*, *Juncus*) are the characteristic plants, and there is some heather (*Erica*, *Calluna*).

1. Looking north-east along the sea beach: on the left First Ridge, on the right the nucleus of a new coastal ridge

2. Looking west across Bramble Bush Bay, nearing low water

3. Looking north-west from Long Dunes across Little Sea

4. Eastern Lake, looking northwards

5. One-acre Pool, looking south-west

inflowing stream, but water drains in from the various marshes, of which Pipley Swamp,[1] at the end of Southern 2, is probably the most important. Eastern Lake, another isolated piece of shallow water (nowhere more than about 1 foot 6 inches deep), is shown in 1924 as occupying just over 6 acres and as cut off from Little Sea, Central, by North-south Dyke. Again there are no effluents. An examination of the dyke in 1931 showed that there was then, in the middle, a gap of several yards through which the water of Little Sea, at least in wet years, had direct access to this lake. The area actually occupied by Eastern Lake fluctuates considerably. In August 1931, a wet year, the water must have covered at a rough estimate at least 12 acres, much of which was open water; while by August 1932 there was no open water and the lake was probably not much over half its surveyed size. The vegetation again is different. Rush and sedge (*Scirpus*) provide most of the aerial vegetation. There is some marsh St. Johnswort, and floating mosses (*Sphagnum* and *Hypnum*) are better developed here than in the other lakes (Plate 4). Pipley Pools are even shallower and are completely dry in a summer like 1932.

West of Little Sea the soil is composed of the clays, gravels, and ferruginous sandstone of the lower Bagshot beds; and the ground rises, gradually from Bramble Bush Bay but more sharply from the lake shore, to form a flat expanse of poor heathland (Plateau Heath) with a more or less damp surface and short sparse heather (*Erica*, *Calluna*). There are several shallow, circular pans which usually hold an inch or so of water; and on the harbour shore there is a fringe of gorse and some bracken (*Pteris*). By Little Sea, Northern 1, nearly 4 acres of this raised land have been enclosed (Plateau Enclosure) by a bank, within which a totally different flora subsists; grasses, bramble, sweet briar, gorse, bracken, ragwort, and some stunted trees, mostly sallow. Heathland, with a few scattered clumps of pines, continues southward, rising to the 50-foot contour line along the ridge of Spur Heath, where plateau gravel overlies the Bagshot beds. At the end of this spur the ground drops steeply to Spur Bog—a sloping bog, with bog asphodel and sundew (*Narthecium*, *Drosera*), of a type not represented elsewhere within the area.

South of this bog the country undergoes a marked change. There are only a few acres more of heathland within the boundary (Wood Heath and Pipley Heath). The rest of the western shore of Little Sea (Southern 1 and 2) is fringed by deciduous woods. Tall trees, mostly birch, rise above luxuriant bracken in the drier open patches, while the wetter areas support a woodland marsh flora in which the fern *Osmunda regalis* is prolific (Twelve-acre Wood). Contiguous to this is a hazel wood (Three-acre Wood). Together these woods are referred to as Southern Wood.

From the southern end of Little Sea to Pipley Bridge lie the dense reed beds of Pipley Swamp, fringing which are beds of rushes and large clumps of low sallow and birch. Eastward the ground rises into Pipley Enclosure, and the flora becomes that of a grass-heath. Bluebells, cowslips, and meadowsweet[2] appear in the spring, to be swamped by bracken later in the summer. Towards the southern boundary the ground becomes densely covered with gorse, and

[1] It is interesting to note that the word "Salterne" appears across the southern tip of this swamp in the O.S. maps.

[2] *Scilla non-scripta*, *Primula veris*, and *Spiraea Ulmaria*.

Fig. 1. From the map in Camden's Britannia, 1607

Fig. 2. From Jos. Avery's survey, published 1721

Fig. 3. From Isaac Taylor's map, published 1765

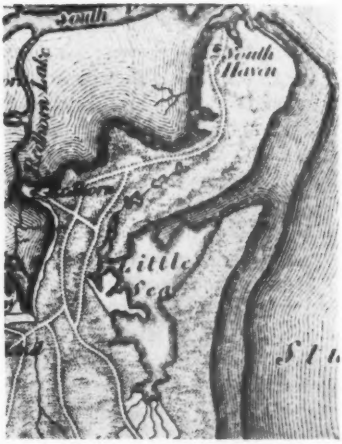


Fig. 4. From the Ordnance Survey of 1811

along the eastern bank of the enclosure a small wood of aspens with thick undergrowth has developed (Aspen Wood). A further belt of trees runs northward bordering Little Sea. The abrupt change from the flora of Pipley Enclosure to that of Southern Heath is quite striking.

Conditions indicated by Early Maps and Charts, 1575–1829

Turning back from the present day to the end of the sixteenth century, a very different picture is presented. The group of early surveys[1] (*e.g.* Camden, 1607: Fig. 1) all agree in showing the peninsula as a narrow "leg" with the "knee" at Redhorn Point and the "toe" about Gravel Point. There is no suggestion of Little Sea or of any land to the east of its present western shore. In short, the land shown agrees remarkably well with the geological map of the exposed Bagshot beds, together with an extension of these to Gravel Point now overlaid by the blown sand of the northern end of Third Ridge.

At this period, then, the greatest width of South Haven Peninsula probably did not exceed 700 yards, and at the narrowest it was perhaps under 300 yards across. The harbour shore-line cannot have differed greatly from its present form; but the old sea "cliff" at the edge of Plateau Enclosure and Curlew Heath is now 1100 yards inland. The southern projection of the old "cliff" can be clearly seen to-day just west of Pipley Pool 3, and is now over 200 yards from high-water mark. The nature of the soil is presumptive evidence that vegetation of a heathy character prevailed. Two large-scale manuscript maps exist, the one "temp Henry VIII," the other dated 1698. These interesting and attractive maps unfortunately add nothing to the detail of the peninsula, but they suggest the presence of the wide sandy beach which is such a pronounced feature in the later maps (Plate 1).

The seventeenth century saw the birth of Little Sea. During its progress Southern Heath was rising out of the sandy floor of Studland Bay, and by the time of Avery's survey (published 1721: Fig. 2) was a narrow strip of land about 1000 yards long enclosing the southern arm. Similarly, the foundations of Third Ridge were being laid with the consequent eastward extension of the northern part of the shore and the enclosure of the northern arm.

I am inclined to place reliance on the general accuracy of Avery's work as it is in good accord, allowing for a lapse of some sixty years, with the detailed work of McKenzie's survey of 1785 (Fig. 5), and the distances between fixed points in the neighbourhood of Poole Harbour show a negligible error when compared with the current survey.

In the early part of the eighteenth century the whole floor of Little Sea was flooded by the tide at high water, and at low tide it was exposed sand with salt water standing in the drainage channels as it does in Poole Harbour to-day[2] (cf. Plates 2 and 3). If Avery is correct, the low-tide mark along the side of Southern Heath was something like a quarter of a mile farther *east* than it is to-day; and there was a tide-washed sandy beach several hundred yards in

[1] Saxton (1575), Camden's Britannia (1607), and Speed (1611) are the most important. G. van Keulen (1727), second chart, and Wilcox (1732), though published later, are clearly derived from earlier surveys. For details of these and other maps referred to, see Appendix, List of Maps.

[2] At this period the name "Salterne" would still be applicable to the Pipley Swamp area.

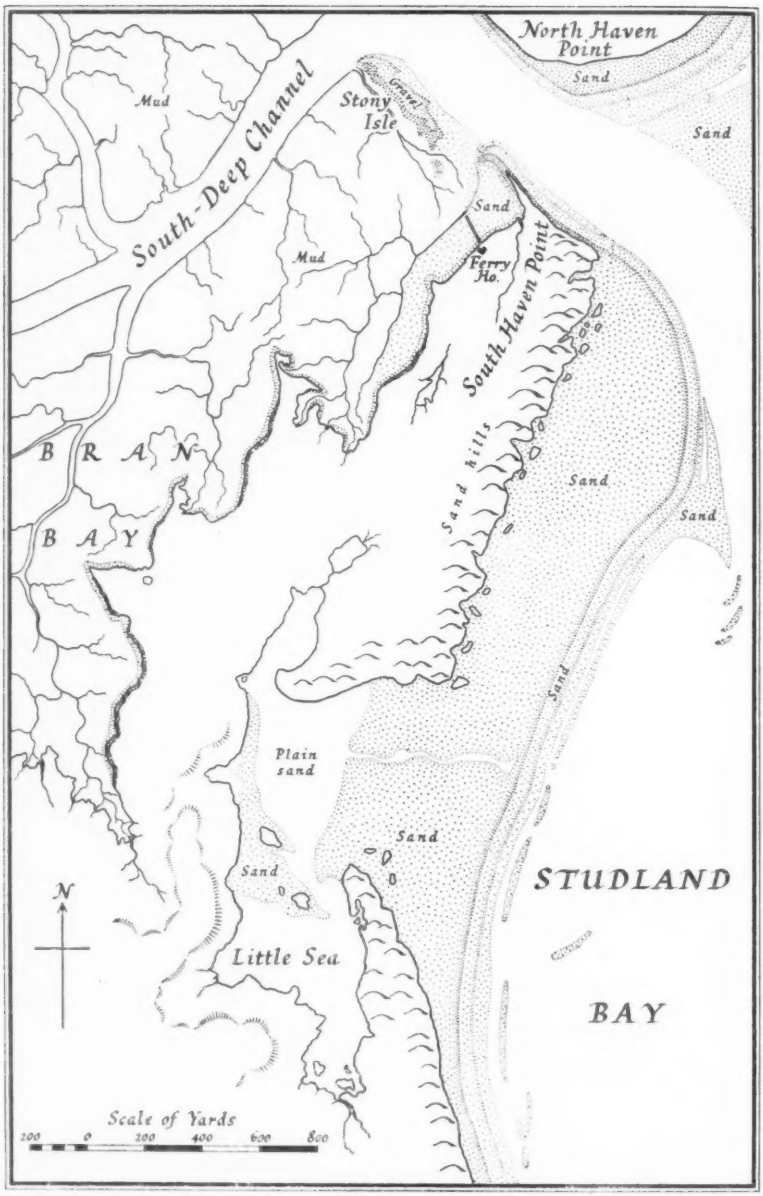


Fig. 5. Lieut. Murdock McKenzie's survey of 1785, drawn, by permission, from British Admiralty charts

width; by 1785 the erosion of this beach to continue the curve of Studland Bay was well advanced. North of the channel from Little Sea similar conditions prevailed, and the distance between the coast-line and low-tide mark was even greater. The beach, to-day covered by First and Second Ridge, was about half a mile wide. The beginnings of the now heather-covered Second Ridge are shown by four little "islands" that stand above the inter-tidal level. These changes must have opened up a considerable area suitable for the development of dune grasses in addition to the pre-existing heathland of the Bagshot beds.

At the north-east point a large island of sand, separated from the beach by a narrow channel, was exposed at low tide. This had mainly been washed away by 1785; no doubt in the process providing further material for land-building. By 1849 however this ball had again silted up to enclose Wild Pool, erroneously called Wind Pool on Taylor's map. Along the north-east coast there is another "island" within the inter-tidal area which comes between South Haven Point, as it then was, and the harbour entrance. It is not quite clear from the map whether tidal water still passed between this and the Point. That harbour water did at one time flow eastwards through this gap is strongly suggested by the deposit of alluvium all over South Haven Saltings and Northern Enclosure.

There does not seem much doubt that Isaac Taylor's map, published 1765 (Fig. 3), was made at a later date than Avery's survey; but it does not suggest that any use was made of the earlier work. There is considerable distortion through elongation; the harbour shore detail is quite incorrect; and the length of Little Sea has been underestimated by almost a half. In the period between the two surveys Avery's elongate "island" along the north-east coast had become joined to the mainland, and was, in 1765, the site of a battery. Taylor's map lends considerable colour to the possibility that tidal water from the harbour still flooded Northern Enclosure at the date of his survey; but the map is so inaccurate that it is just possible (though in my opinion not probable) that his nearly enclosed inlet is meant to represent Bramble Bush Bay. Bayly (1773) and Steel (1804), whose maps show strong affinities to Taylor's, include this feature in a diminishing degree; but there is no doubt that by 1785 the area was not tidal, for McKenzie shows it as a marsh (presumably salt: see footnote to p. 417) draining into the harbour through a short stream. The Ordnance Survey of 1811 (Fig. 4) suggests that at that date Jerry's Point had not yet formed, and that the eastern side of Bramble Bush Bay was then at least 250 yards farther east. The latter would be just possible, as it involves the area now covered by Third Ridge; but Mackenzie, twenty-six years earlier, showed Jerry's Point and the eastern side of the bay to be similar in shape and position to what they are to-day.

The details of McKenzie's chart are remarkably accurate, even to the small inlet in the eastern shore of Little Sea at the base of the neck joining Central and Southern 1. But there is a serious distortion in the proportions of this piece of water, which makes Central and its southern neck 200 yards too long, thus foreshortening Southern 1 and 2 and elongating the overall length from the northern to the southern tip by about 100 yards. The southern arm is thrown too far to the west and Southern 1 is 100 yards too wide. The result of these errors is that the relative positions of Brand's Creek and Southern 1 are quite wrong, and the east-west width of Spur Heath and Brand's Heath is in

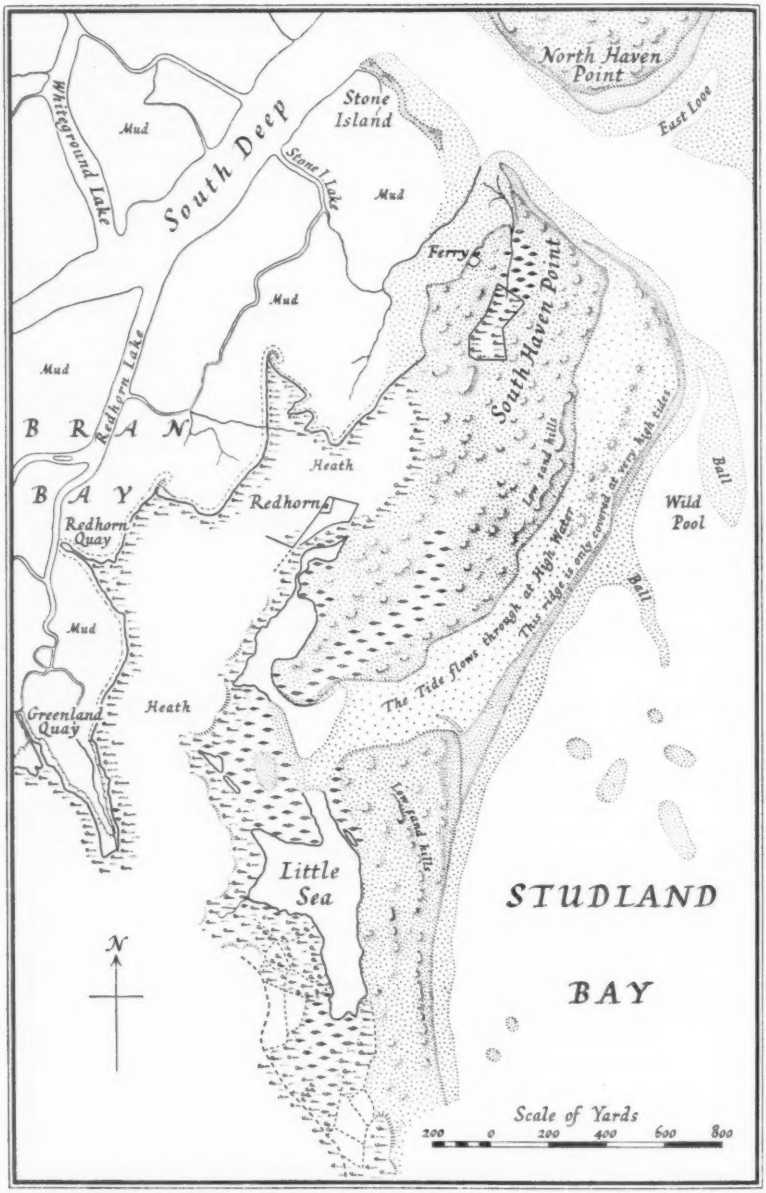


Fig. 6. Captain Sheringham's survey of 1849, drawn, by permission, from British Admiralty charts

defect by about 200 yards. Making due allowance for these discrepancies some interesting facts emerge.

In the southern half of the area the coastal dune ridge followed the line of First Ridge northwards to the fork, then followed the line of Inner Ridge. The remainder of the southern half of First Ridge was built between 1785 and 1849. In McKenzie's time it was flat beach sand.

Little Sea had become a lagoon. A continuous sheet of water, as it is to-day, from which a narrow channel ran across the sand now covered by the marshy border on the south of Eastern Lake. Fresh water drained into it mainly through Pipley Swamp and Spur Bog, and no doubt more directly from the slopes of the bordering heaths. Little Sea Swamp is marked as beach sand (presumably flooded, at least at exceptional high tides) with islands rising from it which correspond to the blown sand islands which rise above the swamp level to-day. Western Arm was a separate pool cut off from Central by a bar of sand.

McKenzie's base line, a mile long, ran from the channel to the north-east coast along beach sand now covered by Eastern Lake and Saltings Strip. Second Ridge had been consolidated since Avery's day into a primary coastal ridge and was still building eastwards. McKenzie records an isolated pool on ground that is now occupied by Third Ridge. It is just possible that this pool represents One-acre Pool, which it resembles in shape, but, if so, it is placed 200 yards too far north in a part of the survey which shows no other distortion. The true One-acre Pool first appears on the 1900 revision of the 25-inch survey. There is no trace of a corresponding pool on any of the intervening surveys. Most of the existing depressions in this part are elongate, and it seems possible that this pool is one that has been subsequently covered by later additions to Third Ridge. There are damp hollows in this ridge to-day.

Several of the inlets in the harbour shore bays were more deeply cut then than they are now. In Plateau Bay there appears to have been most land growth, and a small pond marked behind it no longer exists. Saltings vegetation has presumably been responsible for these changes. Redhorn Quay had not been built on to the end of Redhorn Point.

The only trees marked within the area are a few round Spur Bog (no doubt the forerunners of Twelve-acre Wood); others are marked in Pipley Swamp, and in Pipley Enclosure near the present site of Aspen Wood and along the eastern edge of the reed-bed which is wooded to-day.

Three islands are shown in the end of Southern 2, but they fall within the existing dense reed bed and, if they still persist, are no longer recognizable. No enclosures are marked, and the only house is the Ferry House near South Haven Point, the ruins of which were still standing in 1920. A building, Old Corbands, is shown towards the north end of the peninsula on the survey of 1698. Two buildings, one near Southern Wood and the other near Pipley enclosure, are shown on the early editions of Avery's map, but not on the four later ones.

The first Ordnance Survey of 1811 shows no affinities to previous work. It introduces a new set of errors affecting Bramble Bush Bay and Little Sea, and gives rise to a "family" to which the maps of Dessiou (1813) and the Greenwoods (1826) belong. Concurrently the "line" started by McKenzie

was bearing fruit. The maps issued by Heather (1812) and his successor Norie (1816 and 1827) show a strong family likeness to McKenzie's work. Sparke in 1829 "corrected" the 1785 survey, but unfortunately in his own survey (also 1829) he paid little attention to the accuracy of his land details.

The 1811 survey shows the northern arm of Little Sea as a series of three little ponds connected by a stream. Although one of these would appear to lie on the spot now occupied by New Pool, there is no satisfactory evidence to support this formation. Dessiou, in 1813, omits them, but they are repeated by the Greenwoods in 1826. Sparke, in his own chart, shows one isolated pond which is presumably the connected pond of McKenzie's chart corresponding to Northern 1, but in correcting McKenzie's chart he leaves this as the latter drew it. Little Sea Central was still open to the tides from Studland Bay. The dyke round Little Sea Enclosure appears for the first time in 1811 (it may be noted that, although he marks the other enclosures not appearing on this survey, Sheringham in 1849 does not record this dyke). The system of tracks suggests that there was some activity at Redhorn Point, but it is not clear whether the Quay had yet been constructed. A building is shown near this Point, but otherwise only the Ferry House is marked. An important change, the erosion of the north-east coast, is foreshadowed in this map. A narrow inlet of water is shown to be intruding between the shore-line and the beach, leaving a tongue of sand; a considerable development of this is to be seen in Sheringham's survey.

The eighteenth century was thus a period of continued land-building eastwards, except perhaps for some erosion at the southern end of the beach. Little Sea had changed from a tidal inlet to a lagoon; and the area available for grass-dune communities had considerably increased.

The Surveys of 1849 *and* 1878

From Sheringham's survey, now some eighty years old (Fig. 6), we get a more detailed picture. During the preceding hundred years the sea beach had halved in width, and now begins to show further differentiation. A low ridge of sand "only covered at very high tides" had accumulated near the low-tide mark, and stretched from the end of Southern Heath well round the north-east coast. Thus for the first time creating some barrier to the direct drainage of Little Sea into Studland Bay. The remains of the old drainage channel appear as a small pond just south of the present margin of Eastern Lake; but Little Sea is still met by the tides. Entering through a gap in the middle of the north-east shore (first indicated in the 1811 map) "the tide flows through at high water" between the shore-line and the ridge, over the ground now covered by Saltings Strip, Eastern Lake, and First Ridge (cf. Plates 1 and 4). Within this tidal area however the building of First Ridge had just begun in three separate places which have formed the nuclei of further development. At the southern end the dunes start on the low ridge, to grow northward later into the two prongs that give Eastern Lake its tortuous southern margin. Some 400 yards farther north an isolated sandhill is marked, which grew into the block running from the north of the lake to Central Tongue. These two blocks did not connect till after 1900. Some 500 yards separate this sandhill from the end of the northern line. By 1886 this gap had been reduced to

100 yards, and by 1900 to under 50, while to-day the two ridges overlap by about 50 yards but are still separated by Central Gap.

A new feature appears in Little Sea. It is no longer the continuous sheet of water that it was in 1785, and has since again become. Tide-washed sand stretches round the southern and western sides of Central, cutting off the northern from the southern arm. What has since become Western Arm is now two isolated ponds (instead of one, as in 1785) no longer reached by the tide; and Little Sea Swamp, though its edge is reached by high water, is no longer flooded. All the present margins of Central would at this time have been suitable for the development of a salt-marsh flora. Southern 2 is drawn 150 yards short of its present surveyed length, but in such a way as to suggest the possibility that Sheringham excluded the reed bed from the area of the lake and included it in Pipley Swamp. The islands recorded by McKenzie, which would fall within the reed bed, are not shown by Sheringham.

The dune system on Southern Heath had reached the general configuration that it shows to-day: Lone Dunes in the middle of the Heath; Inner Ridge; and the inner line of First Ridge that points at the island in Eastern Lake. The later development near Eastern Lake has not resulted in a further ridge separated by "slacks," but in an irregular widening of the existing ridge eastwards. In the northern half the shore-line of Second Ridge had reached the position that it occupies to-day. Behind this ridge, running for some 800 yards from the southern neck of Northern 2 and washed at its base by high water, is a flat strip varying from about 100 to 150 yards in width. This flat thus separates Second and Third Ridge and occupies most of the ground now covered by the dense swamp of Central Marsh. It is not marked by Sheringham as sand, but in the same way as South Haven Saltings, Little Sea Swamp, and Pipley Swamp. There is little doubt therefore that it was then marshland. If this is a fact, it is one of some interest, for during the steady land-building of the next thirty years this marsh dried out, and marsh does not begin to appear here again until 1900 (below, p. 417). The rest of the Central Marsh area can roughly be traced between the outlying hillocks of Second and Third Ridge, and the markings here suggest sandy ground with scattered rough pasture. Northern Enclosure, drained by the natural stream marked by McKenzie, appears for the first time. The complete Third Ridge is shown from Gravel Point to the southern neck of Northern 2.

Plateau Enclosure, within which is Redhorn Cottage, and half Plateau Dyke also first appear on this chart. Redhorn Quay had been built, and the development of Sandy Point was well advanced. The word "heath" is written over ground otherwise without markings, and its distribution shows that in 1849 a heather community covered all the Heaths west of Little Sea, but only extended some 400 yards north of Plateau Enclosure over the ground now occupied by One-acre Pool. In short, the middle of the western side of Third Ridge appears to have marked its limit; and there is no indication of well-developed heather on Southern Heath, though forty years later this was described as heathery. In view of the detailed accuracy of the plotting of all the other features it seems incredible that Sheringham should have omitted One-acre Pool or McKenzie's pool had there been any indication of either in 1849.

The network of banks enclosing Twelve-acre and Three-acre Wood are recorded, and more trees than in McKenzie's time are shown in the former; but the hazel copse of the latter is not indicated. The only other trees marked are a small clump in Pipley Swamp. Pipley Enclosure, which is first marked on the 1811 map, is recorded, but the trees marked here in 1785 are not repeated in this chart.

Poole Bar was re-surveyed by Parsons in 1878. This chart brings Sheringham's survey up to date for navigation purposes, and consequently is only concerned with coastal changes. Nevertheless it contains points of interest.

In the twenty-nine intervening years South Haven Point had swung round northwards, approaching the position it occupied in 1900. A short ridge of new dunes running from the Point across the end of South Haven Saltings had arisen. Behind the end of this the short ridges of Northern Dunes had been built. The curved north-eastern end of Sheringham's low ridge had been shorn away, and the coast there had receded by 80 to 100 yards; the tidal inflow had been blocked and the whole of the previous tidal area is marked as marsh. Parsons unfortunately gives no details as to the development of First Ridge.

A curved line of stones had been thrown out for 350 yards south-eastwards from near the point where Sheringham's low ridge began to turn north, thus cutting off what was the northern end of Wild Pool. The old ball of sand had been piled up on the southern side of these stones, giving the coast-line the shoulder that it shows here to-day. The second ball had disappeared, and the coast behind it is shown to have begun the eastward advance that is apparently still proceeding. Curlew Cottages appear for the first time, and a coastguard vessel is shown riding across the spit of South Haven Point.

Changes during Recent Years

Eight years later the new 25-inch Ordnance Survey was completed; and revisions were made in 1900 and 1924. It should be noted that, owing to a difference in method, the lines delimiting the foreshore on Admiralty charts cannot be directly compared with the high- and low-water marks on the Ordnance Survey. The latter shows the movements of "ordinary tides" and the former of springs.

During the last fifty years two general trends in the development of the sea coast-line can be made out. On the north-east coast erosion has continued at a rapid rate, as much as 200 yards in thirty-eight years (1886–1924), while the Studland Bay coast throughout most of its length has advanced eastwards to a maximum of about 80 yards in the same period. The north-east shoulder, that in 1878 was seen to be forming behind the breakwater, had risen above ordinary high-tide mark by 1886 and dune grasses had advanced on to it. By 1900 a short fork of First Ridge had been formed here. During the next twenty-four years these new dunes widened eastwards to the extent of 50 yards, and the North-eastern Tongues of Saltings Strip began to form in the slacks between the successive ridges. In the same period erosion had isolated the old breakwater, so that 40 yards of water lay between it and the coast at ordinary low tide in 1924. Recently the breakwater has again been built up and carried far out into Studland Bay.

During the last two or three years the nucleus of a new coastal ridge has

begun to form on the advancing beach as a hillock of marram opposite Central Gap (Plate 1). Heather in scattered clumps is to-day established on the landward slopes of First Ridge, and, if the land advance continues, the flora and fauna of the dune-grass will again be forced eastward.

By 1886 Saltings Strip, described by the surveyor as salt-marsh, was much the shape that it is to-day, except that the North-eastern Tongues and Central Tongue did not exist (the spread of saltings vegetation into this latter tongue also took place after 1900). At its southern end the Strip skirted round the present floor of Eastern Lake which was then beach sand flooded by spring tides; but its westward progress to the shore of Little Sea was stopped by North-south Dyke, which makes its first appearance on this map.[1]

In his geological survey of 1894 Clement Reid divided Saltings Strip into three parts. The irregular expansion that then existed at the northern end he marked as "water-logged sandy flat." The tips of this area are now below high-tide mark; Shell Bay Dunes and beach sand have smothered about half of the remainder. The next 400 yards are marked as peat with the legend "marsh with bog pimpernel." This part was separated from the beach by the main body of the newly formed First Ridge, already in places over 100 yards wide. The remaining 900 yards are described as "moist sand flats with tufts of rush"; while across the floor of Eastern Lake is written "flooded sand (salt)." Throughout this part the Strip was bordered by beach sand over which the tide could flow through two wide gaps (p. 414) in First Ridge. The existing island in Eastern Lake is represented in the 1886 field sheets as a small sandhill.

Eastern Lake formed between 1894 and 1900, at which date it covered between 6 and 7 acres, its eastern margin meeting the beach sand through an 80-yard gap in the dunes. This gap had closed by 1924 and a triangle of dune had been driven 60 yards into the lake. The salinity of the water to-day (September 1932) is only 25 mg. NaCl per 100 c.c.[2] As will be shown later, these six years saw the initiation of a number of changes all tending to increase the general wetness of the area.

Between 1849 and 1886 Little Sea had again become a continuous sheet of water. The two small isolated ponds (representing Western Arm) had joined up and forced a channel back into Central. From the opposite shore the drainage stream had been cut between Second and Third Ridge, to be crossed after 350 yards by East-west Dyke; and North-south Dyke had finally shut off Little Sea at least from direct contact with tidal water. The salinity of Little Sea (September 1932) was found in Southern 2 to be 10 and in Northern 1 to be 17 mg. NaCl per 100 c.c.

It has been shown above (p. 415) that the southern and really dense part of

[1] Since this was written Mr. B. Harold Smith has informed me that he knew this country well during the eighties and nineties and that high tides, at least in winter, frequently flooded this area. He is further of the opinion that exceptional tides still broke occasionally into Little Sea. On this point all that can be said is that in the years round 1886 it does not seem likely that this occurred, for the land between North-south Dyke and Little Sea Central was at this date not even marked as marshy. That it may have occurred again in the latter half of the nineties seems more possible.

[2] This may be compared with the figure of 210 (definitely saline) found for the water lying among the rushes in Northern Enclosure. I am indebted to Professor A. E. Boycott, F.R.S., for the analysis of the water samples.

Central Marsh, which now flanks the drainage stream, was marsh in 1849. That it was no longer marsh in 1886 there seems little doubt.[1] On the field sheets it is described as "rough pasture," and the markings are those for grass and heath. A small enclosed pond is shown just north of East-west Dyke, and a little to the south a barn. A broken track (cancelled by the revising officer), running across what is now Eastern Lake, apparently led to these. Reid in 1894 marks some half-dozen acres round North-south Dyke as peaty, but otherwise gives no indication of a swing-back to marshy conditions. This peat, presumably, is the older formation laid down between 1849 and 1878, as the tide began to retreat from Little Sea. In the 1900 revision the first signs of Central Marsh appear in the form of a truncated ellipse, 100 yards in length, based on East-west Dyke and flanking the stream. Similarly marsh is shown, where none was marked in 1886, between the margin of Little Sea Central and North-south Dyke; but these two patches are separated by at least 200 yards. In the twenty-four succeeding years marshy conditions had extended, between Little Sea and Northern Enclosure, over an area 1400 yards in length.

West of Third Ridge, One-acre Pool is not marked in 1886 nor referred to in 1894, but first appears in 1900.[2] Since when the surrounding marsh and the lake itself have extended southward, the former by about 200 yards and the latter to enclose a small island. The position now occupied by New Pool is first marked as marsh in 1924, and if the open water, noted by me in 1931, was then present at all, it was insufficient to attract the surveyor's attention. The circular pans on Plateau Heath existed before 1886.

Little Sea Swamp, except for its islands, appears to have been marshy since its formation (between 1785 and 1849). To-day it is extremely difficult, even at the end of a dry summer like 1932, to reach its central island. Western Arm is now, through channels marked as marsh in 1886, directly connected both with the southern neck of Central and with Southern 1. East Marsh began its development after 1900. Pipley Pool 3 first appears on the 1886 sheet. Of Pools 1 and 2 there is no trace on this or on the 1900 revision, but Reid records marshy patches here in 1894. In 1924 they were all marked as pools. Spur Bog existed even in 1785. In 1900 it was still bounded by the lines that appear on the map, but by 1924 it had broken these bounds. To-day boggy ground stretches up the slope well towards the roadside. The growth of the reed beds in Little Sea has also been considerable. There are reasons (above, p. 415) for supposing that the bed at the end of Southern 2 may have been well formed in 1849. The bed at the base of the neck between Central and Southern 1 first appears on the 1900 sheets. The extension along the eastern margin of Southern 2 and the small bed by Spur Bog are first marked in 1924.

In 1886 the number of trees was small. One or two pines are shown halfway along the west side of the stream in what is now Central Marsh; a clump at the end of Third Ridge near the southern neck of Northern 2; a few scattered pines near Plateau Dyke; a mixed clump within the enclosure of Curlew Cottages; scattered pines on Spur Heath; a clump on the central island of Little Sea Swamp; and one or two others on the drier parts of this area. By 1900 the several clumps of deciduous trees on both sides of the northern half

[1] Since confirmed by Mr. B. H. Smith.

[2] Salinity, September 1932, 10 mg. NaCl per 100 c.c.

of Central Marsh had started; the isolated pines on Plateau Heath had increased in numbers; and the clump round Curlew Cottages and those on Spur Heath had spread considerably. New pines are shown on what has since become East Marsh and on the dry strip that now marks its northern limit. One of the pine clumps on Spur Heath was cancelled in the 1924 revision; but the main change in the period between these revisions was the increase of deciduous trees, principally on the east side of the three necks between Northern 1 and Southern 1. Since 1924 the number of isolated pines on Plateau Heath seems to have decreased. Clumps of sallow and birch are still developing; one, now in an early stage, near Northern Enclosure; a number of bushes along the western side of Saltings Strip; single bushes in the Strip near North-south Dyke; and scrub round Western Arm Marsh.

In 1886 there was only one small clump of trees in Twelve-acre Wood, a fringe along the lake margin and a few disconnected patches of brushwood; the rest was open heath. Most of Three-acre Wood was the same, but a small belt of brushwood is marked at its southern end. No change was noted in 1900; and it is not till 1924 that this area appears connected up into more or less continuous woodland. The patches of brushwood marked in Pipley Swamp have increased steadily since 1886. At that time Aspen Wood was shown as two disconnected patches of brushwood; and no trees were marked at the northern end of Pipley Enclosure or on Southern Heath.

Both the cottage near South Haven Point and Curlew Cottages were ruined by 1920. The former has now completely disappeared, and there are two temporary buildings within its old enclosure. The cottage in Plateau Enclosure (called by Sheringham "Redhorn") was present in 1886 but was cancelled in the 1900 revision, and there is now no trace of it. The barn near East-west Dyke does not appear after 1886. At the northern end of Pipley Enclosure there was a boathouse in 1900, but this had disappeared by 1924.

General Discussion of the Development of South Haven Peninsula

The history of the Peninsula, as revealed by this series of surveys, may briefly be said to be one of steady land-building from the floor of Studland Bay against the long-existent backbone of the Bagshot beds with the complications incidental to the blocking of drainage outlets; and of the subsequent plant succession in which man has interfered only to a small degree.

The old-established land is roughly that lying to the west of the arc made by Little Sea and One-acre Pool.[1] It may reasonably be assumed that heath vegetation has existed on Spur Bog and Spur, Brand's, Western Arm, Curlew and Plateau Heaths through an indefinite period; but all that can be said definitely is that such a distribution was present in 1849. Pipley Swamp and part of Spur Bog have undoubtedly been marshland for the last hundred and fifty years. Whether Pipley Enclosure is old natural grassland or a product of human interference, similar to that which differentiated Plateau Enclosure from the surrounding heath, cannot be determined on the evidence available to me. Avery marks a house near it in 1721, and another by Southern Wood;

[1] This arc is carried on along the coast of North Haven Peninsula to make one continuous sweep of Poole Bay from the Foreland to Hengistbury Head—a symmetry now broken by the new land built up on South Haven Peninsula.

neither of these buildings appears on the later maps. Plateau Enclosure seems to be the product of the middle and latter part of the nineteenth century, but it is fair to assume that at least for the last thirty years it has been in open competition with the surrounding flora. The country to the east of Little Sea, considerably more than half the land area, is, in its present form, of quite recent origin, and is apparently still being built up eastwards.

Southern Heath is over two hundred years old, and Inner Ridge has certainly stood for a hundred and fifty. The history of Second Ridge is known in greater detail. Two hundred years ago it was just foreshadowed as the new coastal ridge, and in the succeeding hundred years its development was completed. The foundations of Third Ridge were laid over two hundred years ago, but whether the whole ridge was completed by that time cannot be determined. The fact that it was not marked as established heath in 1849 suggests that its dunes cannot be much older than those of Second Ridge. In probably less than three hundred years Little Sea has not only come into existence, but has passed through all the stages between a tidal inlet and a freshwater lake.

Northern Enclosure has been land, though marshy, for a hundred and fifty years; but it is possible that it was still tide-washed in the middle of the eighteenth century. The land north of it was not joined to the main body in the early part of that century. In the latter half of the nineteenth century dunes were built up along the north-east coast, only to be levelled again by the rapid erosion that set in towards that century's close. Other ridges formed behind them as the tide scooped out Shell Bay. This process has played a considerable part in the history of Saltings Strip. Eighty years ago this strip was tide-washed sand and First Ridge was only in its embryonic stage. Within twenty years however the northern entrance of the tide had been blocked and saltings vegetation was well developed. Though cut off at the northern end, the southern half remained open to the tides till at least the beginning of the present century. Possible inlets for exceptional tides still exist in the North-eastern and Central Tongues; but across the mouth of the latter a new coastal ridge is already foreshadowed.

One marked result of this steady dune building has been to block every natural outflow for fresh drainage water. An attempt to counteract this is to be seen in the stream; but this has proved inadequate, and the last thirty or so years have seen the complete development of Central and East Marshes and the formation of the three isolated pools. Another result has been that areas like the margins of Little Sea Central and the southern half of Central Marsh, which eighty years ago were only suitable for a salt-marsh flora, are now left far inland. The spread of heather at the expense of grasses has during the same period pushed the dry grass communities, both faunal and floral, to a marginal distribution.

Trees do not play a large part in this area; but the growth of sallow and birch clumps, of the small woods in the south, and of pines in clumps or singly has proceeded steadily during the last forty years.

The future courses of these various trends depend largely upon three factors: the results of tidal action on the east and north-east coasts, and the relative rise or fall of the inland water-level, and the amount of interference by man.

APPENDIX

A List of Maps and Charts including the Entrance to Poole Harbour

(*The comments on the accuracy of the maps relate entirely to South Haven Peninsula*)

Sixteenth Century

A large-scale coloured plan (5 feet long) of part of the South Coast: "Temp Henry VIII." British Museum (Cott. Aug. I, i, 31 and 33). An interesting map giving only an approximate outline of South Haven Peninsula.

Saxton's Atlas of 1579. The Dorset map is dated 1575.

Seventeenth Century

Camden's Britannia, 1607.

Speed's map, 1611.

John Seller: The English Pilot, 1671. Includes a small-scale map of Poole Harbour, which is valueless.

Captain Greenvile Collins: Great Britain's Coasting Pilot, 1693. Contains no chart of Poole Harbour, but states in the text (p. 4), "I have not yet surveyed Pool Harbour, but 'tis intended God-willing" (see below, 1723).

Edward Dummer and Captain Wiltshaw, Commissioners of the Navy: A coloured plan of the Haven and Town of Pool: surveyed 1698. British Museum (Sloane 3233 12). This plan gives an approximate outline of South Haven Peninsula; no trace of Little Sea; and an indication of a wide sea beach. Sandhills are shown on North Haven Peninsula, but not on the South Haven side.

Eighteenth Century

Jos. Avery: "An exact Draught (being an actual Survey) of the Sea Coast from Arundel in Sussex to St. Albans in Com̃ Dorset"; scale 0·65 inch to the statute mile. A reliable map reissued a number of times throughout the century. I have seen the following copies:

(i) An unbound sheet (Brit. Mus.) to which is ascribed the approximate date "1720."

(ii) Capt. G. Collins: Great Britain's Coasting Pilot, 1723. The remark quoted above from the 1693 edition still appears in the text (p. 2), but Avery's map is included and bears the remark, "Sold by R. Mount & Compy on Tower Hill, London." below which is the date 1721. This is the only dated copy I have seen.

(iii) G. van Keulen's Atlas, 1727. A chart identical with Avery's is included.

(iv) A maritime Atlas, 1779: published by Robert Sayer & John Bennet.

(v) A Complete Channel Pilot: published by Sayer & Bennet between 1781 and 1784. The other charts are dated, but Avery's is not.

(vi) Stephenson & Burn's Channel Pilot, 1790: published by Sayer. The copy of Avery's chart is given as revised in 1790 by George Burn, a master in the Royal Navy.

(vii) A collection of charts by Chandler & Steel, etc., 1794: published by Laurie & Whittle "as revised in 1794 by George Burn. . . ."

The outline of the Peninsula is repeated as Avery drew it in all these editions; the only difference within this area is that in editions (iv)–(vii) two buildings previously shown at the southern end of Little Sea no longer appear.

G. van Keulen's Atlas, 1727: contains, besides Avery's, a second chart on a

smaller scale which from its configuration is clearly of much earlier date (presumably seventeenth century).

John Wilcox: A Survey of Dorsetshire, 1732; includes a map of the Speed type; scale 0·33 inch = 1 mile.

Isaac Taylor: Map of Dorset, 1765; scale 1 inch = 1 statute mile. Not reliable; distorted by elongation.

J. Bayly: Map of Dorset, 1773; scale 0·4 inch = 1 statute mile. Similar to Taylor's map.

Lt. Murdock McKenzie, R.N.: 1785: Ms plans on scales of 2 inches and 6 inches to the statute mile (Hydrographic Dept., Admiralty), published 1810. An accurate map with little distortion.

W. Tunnicliff: The Western Circuit, 1791. A featureless map; scale 0·31 inch = 1 statute mile.

Nineteenth Century

W. Price, Master of H.M.S. *Theseus:* A new chart of the Isle of Wight with the adjacent coast of Hampshire, 1800; reissued without change in 1831. A small-scale map of no importance.

David Steel: A map of the coast from Selsea Port to Poole Harbour, 1804; made "by order of the Government" and "regulated by the grand trigonometrical survey"; scale about 0·5 inch = 1 statute mile. Inaccurate, showing the elongation of Taylor's map.

The Ordnance Survey of 1811 under Lt.-Col. Madge, drawn to a scale of 2 inches and issued at 1 inch to the mile. Shows several marked inaccuracies. Reissued without alteration until the issue of the new 25-inch edition.

A map published by William Heather, 1812; scale 0·67 inch = 1 statute mile. Outline only, showing strong affinities to McKenzie's map. Reissued by by J. W. Norie (successor to Heather) without change, 1816 and 1827 (A chart of part of the South Coast from Owers to Bridport, in A Complete Pilot).

J. F. Dessiou: published 1813: A map "compiled from the maritime surveys of Admiral Knight and from sundry others since taken, the whole adjusted to the Trigonometrical Survey of England and Wales made by Lt.-Col. Madge" "verified from recent observations purposely made by Joseph Foss Dessiou." Follows the O.S. map of 1811 closely; scale 0·98 inch = 1 statute mile. I can trace no surveys by Adm. Knight affecting this area.

C. and J. Greenwood's map: published 1826; scale 1 inch = 1 mile. Follows the O.S. map of 1811.

Lt. T. Sparke, R.N.: 1829; Ms plan (Hydrographic Dept., Admiralty); scale 2 inches = 1 statute mile. Similar to McKenzie's map, but land detail not so accurate. In the same year Sparke "corrected" McKenzie's work, and this was published on a scale of 2 inches in 1835. This "correction" leaves the land detail of McKenzie untouched.

Captain Sheringham, R.N.: 1849; Ms plan (Hydrographic Dept., Admiralty); scale 8·68 inches = 1 statute mile. An accurate and detailed survey.

Staff Captain Parsons, R.N.: 1878; revision of coastal detail of Sheringham's chart; scale 3·47 inches = 1 statute mile (Hydrographic Dept., Admiralty).

(Further revisions of the coast-line only were carried out by naval surveyors in 1891, 1897, 1922, and 1924.)

The Ordnance Survey to a scale of 25·344 inches = 1 statute mile was made in 1886 and revised in 1900 and 1924.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: We are to hear this afternoon a detailed description of the relation of plant life to land formation in a particular area, how each affects the other, and also of the upbuilding of the land from the sea. Captain Diver, our lecturer, will, during his description, travel back some way into the past and from that bring us up to the present. Captain Diver was at school at Dover and then went to Trinity College, Oxford. Having served in the war, he now watches the growth of other places, for he is a Clerk in the House of Commons.

Captain Diver then read the paper printed above, and a discussion followed.

The PRESIDENT: I will first call upon Professor Salisbury, Professor of Botany in the University of London.

Professor E. J. SALISBURY: May I, first of all, thank you for the opportunity you have given me of listening to Captain Diver's very able account of historical topography. It is extremely interesting as an example of the value of co-operation between the geographer and the ecologist, and I should like, in the few minutes at my disposal, to emphasize one or two of the aspects in which such co-operation is of inestimable value to us.

First of all, I might call attention to the fact that some years ago an interesting species of plant, *Isoctes echinospora*, was recorded from Little Sea. The interest of this plant is that it is a species characteristic of Northern Europe, which extends right into the Arctic, and is also found in Central Europe, but at relatively high altitudes. I hesitate to think what fairy tales enthusiastic advocates of preglacial relics might have woven around this species, were it not for the indisputable evidence which Captain Diver has produced that Little Sea was only in a condition to support such a type within the last one hundred and fifty years. We can see here the value of such geographical studies in relation to distribution.

But it is particularly as an ecologist that I am interested in such studies. The ecologist and the geographer, I suppose, thirty years ago had far less in common than they have to-day. At the time when the "British Vegetation Committee" was inaugurated by a few enthusiasts in this country, the whole of the study of vegetation could have been represented in two dimensions. Later on came the recognition of the structure of plant communities and the three-dimensional concept. It is only comparatively recently that the fourth dimension has been emphasized, and in no community is the importance of the fourth dimension—the time factor—so well shown as in the development of sand-dunes.

Some years ago I had the opportunity of studying in detail the sand-dune systems of the Breton coast, those at Blakeney on the Norfolk coast, and the sand-dune system at Southport, and by a study of samples from the parallel ridges which you have seen represented in the area under discussion, one was able to say that the early phases of sand-dunes are usually characterized by an alkaline reaction owing to the comminuted fragments of shells, and that with the passage of time the calcium carbonate is gradually leached out; also with the passage of time and increase of vegetation accompanying that passage of time, there is an increase in organic material, and consequently an increase in the water-holding capacity of the soil. There has been, then, a definite succession of the soil, accompanied by definite changes in vegetation.

Now it so happened that two of these areas I was studying were particularly fortunate in providing a certain amount of dated material. One could date, roughly, the age of the dune ridges. It cannot be over-emphasized how important it is to the ecologist to obtain data such as Captain Diver has been giving us in order to date the period which is necessary for these changes to take place, the

more so that certain striking differences are evident when we compare various dune systems.

For example, in the dune system that we have just been hearing about, the First Ridge, which I believe is about eighty years old, already bears heather. On the Southport dunes heather did not appear until about 150 to 200 years after the ridge first began to form. Of course I am aware that the Southport dune system is in a wetter climate, but then that wetter climate should hasten the arrival of the heather by causing more rapid leaching. When I examined some of the samples from the sand-dune system that Captain Diver kindly collected for me I found that the explanation of the early arrival of heather would appear to be the fact that the sand of the Studland dunes is remarkably deficient in calcium carbonate; also it is noteworthy that the early stages of dune formation were extraordinarily poor in organic material. Whether these facts have any material bearing upon the paucity of the fauna, I am not sufficiently a zoologist to judge; but I think I have said enough to emphasize the value to the ecologist of the co-operation between the geographer and biologist, and I hope this is the prelude to many such studies. I am certain that more co-operation between geographers and ecologists would be of great benefit to both.

Mr. CHARLES OLDHAM: Any new land area or any existing area which is subjected to drastic changes, such as the removal of woodland or cultivation of the area, is of particular interest to the biologist, for he is enabled to estimate and test the rise and fall of successive plant and animal dynasties until something like equilibrium is established.

The area about which Captain Diver has been speaking to us is, I think, for two reasons, of particular interest. First, because he is able to fix, approximately at any rate, the date at which the various parts of the area came into being, and secondly because the blown sand in the Studland area is, it seems to me, a special case. Looking at the blown sand at Southport, or Blakeney, or anywhere in Cornwall or Devon, or places I am familiar with in South, Mid-, and North Wales and farther north along the Lancashire coast, in Lincolnshire on the east, and in various places round the coast of Scotland, you will see something that looks altogether different. The least observant person could not help being struck by it. When Captain Diver took me to see the blown sand at Studland I could hardly believe it was blown sand; it looked so different from the areas with which I am familiar. The explanation has just been given by Professor Salisbury: that there is a great deficiency in lime in the blown sand in Studland Bay. Most of the places I have spoken of on the west and east coasts of England and the north-east of Scotland have a definite and considerable lime content in the blown sand. The lime is mostly derived from the more or less finely comminuted fragments of marine shells which have blown up with the sandy deposits themselves. It was a great revelation to me to see the Studland dunes covered by ling and heather; and instead of the bee-orchis, the carline thistle, and other lime-loving plants, to see heather, sundews, and other definitely acid-loving plants.

I went to Studland primarily to look for snails. I found very few, and I was not surprised when I had seen the heather, for I knew by that token that there must be a deficiency in lime. As a matter of fact, the only snail I found on the whole of the newer part of the swampy area was a slug, *Agriolimax laevis*, which is, I believe, the most tolerant of acid conditions of any of our land and fresh-water molluscs. It is very difficult to prove a negative and to say there are no small snails on that new-blown sand, because some kinds are only to be found by intensive searching; but it is quite safe to say that such creatures as *Helix aspersa* and *Cepaea nemoralis*, quite noticeable and hefty creatures, are not there; whereas if you go to, say, Southport you will see both those species flourishing in

countless thousands, and if you go to the north of Scotland beyond the range of those two species you will find another two, *Cepaea hortensis* and *Arianta arbustorum*, in great abundance on the sand-dunes. Nothing of the sort was to be seen in Studland, nor were there any *Helicella itala* or *Helicella virgata*, which are also typical sand-dune species in most parts of the British Isles.

It was very interesting however when one came to hunt on the heaths on the eastern side of Little Sea. In that place known as the Plateau Enclosure, which was subjected to cultivation some eighty years ago, I found three kinds of snail. They were living under bricks, and no doubt the mortar which was on the bricks had attracted them. I suspect they had been taken there. The little settlement where once stood Curlew Cottages yielded eleven species, also on the bricks and mortar. Elsewhere on the Heath you might search in vain for any one of the eleven. But of particular interest to me was the fact that Captain Diver on the new road which has been cut across the Heath from Poole Harbour to Swanage—the new road where he told us there were plants that were not calcium haters—found, in considerable numbers, two of the very snails which are so characteristic of limestone areas and of sandhills which have a fairly high lime content. Those two, *Helicella virgata* and *Helicella caperata*, I have not the least doubt, were there because of some material which has been brought along the road which made things more happy for them than they would be on the dunes themselves.

As to the snails in the fresh water. In the One-acre Pool I hunted hard but could find no snails; there were some larva newts which must have got there fairly recently, because newts can stand no salt at all. Again, in the South-eastern Pool there were no snails; in Little Sea there was a very poor snail association. Given a favourable area of that size—favourable from the snails' point of view—you might find something like twenty species. I found four. One of them, the common *Limnaea pereger*, which is everywhere in fresh water, was here, but it was a poor depauperate representative of its species. It could exist, but only just. A little bi-valve, *Pisidium ostusale*, which is characteristic of peaty pools in moorland places, was there too, and another little bi-valve shell, *Pisidium cinereum*, which is tolerant of very varied conditions. The vegetation of these pools largely consists of marsh St. Johnswort (*Hypericum elodes*), a plant that hates lime, and it prepared me for what I found—hardly any snails. It is, I think, not too presumptuous a conclusion to come to that the snails are not there, not because they could not have got there somehow or other; they are not there because, when pioneers did arrive, the area was not fit for them to stay in.

Dr. T. G. Longstaff: There is very little I can contribute to the discussion, though I have personal knowledge of and great affection for the area which has been dealt with. I have very much enjoyed the paper this afternoon and also the discussion. There is one aspect I would like to mention, though without much hope. This is a very remarkable and interesting area. It is a scientific laboratory, as the lecturer and a whole team of workers have shown. You can watch a world being made in miniature. Yet the place is threatened by that awful thing which we call Progress. The landowner is driven to sell his land there because of heavy taxation and because he gets nothing out of it. If he sells it for "development" he will immediately become not only a richer man but a virtuous citizen, because he ceases to be a wicked landowner. If it was possible to buy this land and get the area turned into a sanctuary it would be a very valuable asset to posterity. We could look forward to successions of students experimenting and observing for the next one hundred years in that laboratory. If any among you know a millionaire with a sense of artistry in his soul you might endeavour to persuade him to preserve this area for the nation.

Mr. J. A. Steers: I have been very interested in Mr. Diver's paper, and have

listened closely to the discussion. But the paper and the discussion have dealt mainly with biological matters, and after Mr. Oldham's disquisition on snails, I am afraid the remarks of a physical geographer may be rather dull.

Professor Salisbury alluded to the connection between biology and geography which was made in the paper. I am not sure if I am in entire agreement with Professor Salisbury, because I feel that the fundamental problems of physical geography, in so far as they relate to this area, were not mentioned. Enclosing Poole Harbour are two spits of land, the one described in this paper and the other running west and south-west from Bournemouth. Their actual formation is the point that interests the geographer, and this was not discussed. So far as I know there is no complete account of these spits available. Presumably tidal currents and wind waves have been the factors involved in their construction, and of these, waves are the more probable. The general accounts of the formation of spits and similar features as given in text-books still stress far too much the work of tidal currents, and in these two spits enclosing Poole Harbour there appears to be an excellent opportunity for an investigation of the problem.

In Mr. Diver's nomenclature of the ridges the one nearest the present shoreline was, if I remember correctly, called the first ridge. While superficially this appears to be the case, it is a little unfortunate that it should be so called, because the general impression left on my mind is that it was the last in order of formation. Judging by analogy, the earliest ridges should be those farthest from the present beach.

I was particularly interested in the way the speaker was able to trace the growth of the peninsula from old maps and charts. It is not often one is so fortunate. At Orford Ness I was able to get some very illuminating documents, but at Scolt Head Island, a place in which I am now very interested, it seems impossible to find any such useful charts—unless there are one or two locked away in some private archives and forgotten. Scolt Head Island (in Norfolk) presents some parallels with Mr. Diver's study. At the present time an investigation, geographical and ecological, is being carried out there; but my difficulty has been to attract biologists. Fortunately that difficulty is now partly overcome, and the last time I met Mr. Oldham was in September 1932, when he was staying on that island.

In conclusion I would like to congratulate Mr. Diver on his very attractive paper, and to urge him to tackle some of the more purely geographical problems.

The PRESIDENT: Is there anybody else who would like to add to the discussion?

Mr. G. M. LEES: I have listened to the paper with great interest, but I rather join with Mr. Steers in asking for more. The lecturer started by presuming the existence of this peninsula which stands out so prominently blocking Poole Harbour, but he did not give us any indication of the process involved in its original formation or in its subsequent growth. He showed us geological maps and described how the synclinal nature of Poole Harbour caused a slow subsidence, whereas the peninsula in question was being built up presumably by an opposite process quite independent of its geological structure. Can Captain Diver correlate his observations with data from other parts of Poole Harbour and give some indication of the extent to which the more general sinking is still going on?

Captain DIVER: I do not think I can really answer that question, for I have only concerned myself with South Haven Peninsula, and I am not a physical geographer. I have no idea why this peninsula has remained above the rest of the sunken area of Poole Harbour. The building-up process is quite a different question, and I assumed that it was probably due to the fact that the current from Poole Harbour turns southward at the mouth and gives the spit a certain amount

of protection; this possibly affects other currents and allows the silting up of sand. If you refer to the Geographical Types sheet, and compare it with the 1600 map, you will see that the original line of Poole Bay was one continuous sweep, resulting from the erosion of the Bagshot beds. The new land, which now breaks that continuity, has been added by these different processes.

The PRESIDENT: May I, first, Captain Diver, congratulate you on one thing: that two speakers have asked for more. That is always a compliment, for it shows they liked very much the fare which you provided. In this Society we welcome more and more each year the type of lecture which combines the geographer with those studying kindred subjects, the ecologist or whoever he may be. I can assure Professor Salisbury that we recognize that very particularly, and that more and more will we welcome lectures and discussions of this kind.

There are one or two remarks which I wish to make, but please do not think I make them in any spirit of levity. I confess I did not know before Mr. Oldham spoke that there was much difference in the existence of any one snail from any other snail or that they had more in them than just existence. The reason I mention that is that when Mr. Oldham introduced matters of that kind he opened up to those of us who are amateurs on certain subjects new subjects of interest that all can find some enjoyment in.

The admirable disquisition on economic politics given by Dr. Longstaff would form a subject for discussion—but not here; perhaps Chatham House might like to take it up. Dr. Longstaff made one remark on which I cannot agree with him. He said that Progress was created. That is a question which would also afford opportunity for a very lengthy discussion.

Captain Diver, my business is to sum up and give you what is always a great pleasure, our very sincere thanks for opening up subjects which are not only of great interest but of very real use. I only hope that you will continue your researches and that you will in the future come here again to tell us about them. You will receive as warm a welcome as, I am sure, you have received this afternoon. I hope you will accept our sincere thanks.

OBSERVATIONS ON CERTAIN ANTARCTIC ICEBERGS

J. M. WORDIE AND STANLEY KEMP, D.SC., F.R.S.

IN the course of the oceanographical investigations which are being made in the Antarctic by the research vessels employed by the Discovery Committee a number of remarkable icebergs have been sighted. Some of these are of interest on account of their enormous size, and others on account of their dark colour. The present note is concerned with bergs of both these kinds.

Bergs of dark colour, called for convenience black and white bergs, have been observed with some frequency off the mouth of the Weddell Sea. When opportunity occurred for close examination it was found that these bergs are of two distinct varieties: one of them is the true morainic berg, in which the dark portion is quite black and opaque and consists of mud and stones which are often clearly visible; while in the other variety the dark part proves on closer approach to be translucent and of a very deep green colour, resembling that of some kinds of glass used in bottle making, and mud and stones appear to be absent. We can speak then of black and white bergs falling into two subdivisions, the morainic and the bottle-green bergs. At a distance the two kinds resemble each other very closely, and it has been found that they have some features in common. In both of them as seen by us the dark part is always smoothly rounded by water action, and in both, with few exceptions, the junction between the white and dark parts is a perfectly straight clean-cut plane.

To obtain samples of either variety for examination is not an easy matter, for in the heavy swells that prevail close approach is often impossible and the surface is generally so smoothly rounded that it is extremely difficult to chip pieces from the berg. Rifle shots at close quarters have been tried without success. So far, on the Discovery Committee's ships we have not been able to collect any sample from a bottle-green berg; the only material we possess is from a morainic berg, collected by Mr. G. W. Rayner in the *William Scoresby* at 70° 01′ S., 100° 39′ W., on 1 February 1930, and this has been examined for us by Mr. G. H. Tipper. He reports that there are four large pebbles, of pink granite, hornfels, banded grey quartzite, and dark quartzite respectively; these specimens show few signs of ice action and are free from scratches or striae. The silt associated with the pebbles is dark grey when dried and almost black when wet; the very fine portions are composed of minute angular fragments of quartz and other minerals; the coarser material is a mixture of angular and rounded fragments of igneous and metamorphic rock. The silt is slightly calcareous, due to the presence of foraminifera and minute lamellibranchs: the foraminifera, determined by Dr. W. A. Macfadyen, are all present-day species. The presence of marine organisms with the morainic material is unusual. They may perhaps have been scraped off the sea bottom by the berg before overturning. It is more likely however that part of the sea floor has been incorporated in the parent glacier in the way suggested by Professor Debenham in his account of raised marine muds in Antarctica,[1] and that the berg can be described therefore as truly morainic.

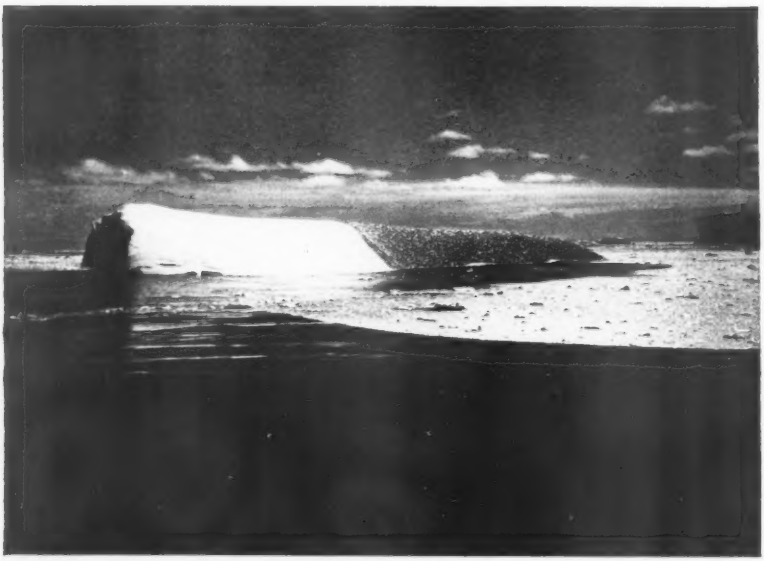
[1] *Quart. Journ. Geol. Soc.*, vol. 75 (1919), pp. 51–73.

1. Bottle-green berg seen near Visokoi Island, South Sandwich group

2. Another bottle-green berg seen at the South Sandwich Islands

3. Bottle-green berg seen in lat. 54° 44′ S., long. 27° 33′ W

4. Black and white berg seen near Elephant Island



5. Another view of the same berg

In addition one of us (J. M. W.) made an examination of a black and white berg found in the Weddell Sea pack-ice in 1915. The berg in question was known on board the *Endurance* as the Stained Berg by reason of its dark appearance seen from the ship 6 miles away. It was visited on 24 September 1915, and again on 17 December. The berg was measured as 110 feet high, and consisted of a lower white portion overlain by dark ice about 50 feet in thickness. The boundary between these was straight and even, but steeply tilted. The lower part was blue ice, close and compact in structure, not showing any stratification, but with the same névé structure as barrier-ice; the upper dark part had some very small dirt specks scattered through it, and the structure was described as "very bubbly—almost névé-like." A special feature in the upper part was the presence of steeply inclined bedding planes, described as recalling the even stratification seen in barrier bergs; these were parallel to the line of junction between the black and white portions. On the day of the first visit it was thought that the darkness of the upper portion was probably due more to its peculiar "bubbly" structure than to the dust particles. It was emphasized that the bedding was not of the nature of dirt bands but of the same nature as barrier stratification. Specimens of the two kinds of ice were later examined at the ship together with a portion from an undoubted barrier berg. The specific gravity of the latter was 0·874, of the dark ice of the Stained Berg 0·871, and of the lower clear ice 0·884. Pieces of the dark ice showed bedding planes on a fine scale when held up to the light. The samples of ice were then melted down, and from the dark ice a very minute residue was left of fine mud and what was presumed to be plant tissue. Somewhat similar residues had previously been found at two other bergs earlier in the year. A note was made at the time that somewhere round the Weddell Sea there must have been "bare rock with plant life, fragments of which are blown by the wind on to the near-by barrier and glaciers, where they are then cemented into névé."

These observations introduce the view therefore that some of the black and white bergs may owe their dark colouring to fine material transported by the wind on to the surface of the glacier.

Illustrations of bottle-green bergs are given in Plates 1–3. The first two of these were found off Visokoi Island in the South Sandwich group on 2 March 1930. Plate 3 is a photograph of a berg seen on 31 October 1930, in 54° 44′ S., 27° 33′ W., and shows how closely such bergs can resemble partially submerged rocks.

In most of the black and white bergs, as already remarked, a clear-cut plane of demarcation is to be found between the white and black parts, as shown in Plate 2 and in the berg, presumably morainic, illustrated in Plates 4 and 5[1]. This berg was seen on 18 December 1930, in 60° 13′ 15″ S., 50° 51′ 30″ W. On the theory of wind-borne detritus the plane of demarcation must originally have been more or less horizontal, the detritus having fallen on the level surface of the glacier. Further accumulations of névé, but free of dust, might result in the formation of the very remarkable banded berg seen on 1 April 1931, north-west of the South Sandwich Islands in 56° 30′ S., 31° 28′ W., and shown in Plate 8. This berg was about 140 feet high and 1500 feet in length and was

[1] From this point of view the black ice appeared greyish, owing to the reflection of points of light from its faceted surface.

traversed from end to end by a perfectly straight band of dark material 15 feet thick. Along the face shown in the photograph this band was 40 feet above water-level, but at the sides it was seen to dip downwards. The berg was smooth and wedge-shaped, and had evidently capsized.

Another peculiar berg is illustrated in Plates 6 and 7, and from the fact that it was found only some 30 miles to the north of the banded berg (56° 33′ S., 32° 07′ W.), and on the same day, it appears likely that it came from the same locality. It was domed, about 1500 feet in length and 150 feet high at one end. This was one of the few black and white bergs sighted which does not show the usual straight line of demarcation between black and white. The dome is capped with black, but on two sides blackened portions extend downwards in V-shaped fashion, giving the impression that material might have collected in crevasses in the glacier surface. In this berg the white ice was perfectly smooth, but it was noted that the black parts were pitted all over with shallow pock-marks.

There is no evidence that the black ice melts more quickly than the white; as will be seen from the photographs, the black and white portions merge without any alteration in surface outline. The smoothly rounded outlines are no doubt due to water action before the berg capsized, ice above water melting very slowly in the low air temperatures of these latitudes.

From the observations made it seems certain that black and white bergs are not all formed in the same way. In the one examined in 1915 the evidence points to an origin from wind-borne detritus. We think therefore that minute specks of wind-borne dust might possibly account for the appearance of the unexplained bottle-green bergs, which on their dark portions sometimes have a faceted or even honeycombed surface. On this point however we feel that further speculation is idle until actual specimens have been collected.

The dark bergs which we have seen might be classified as follows:

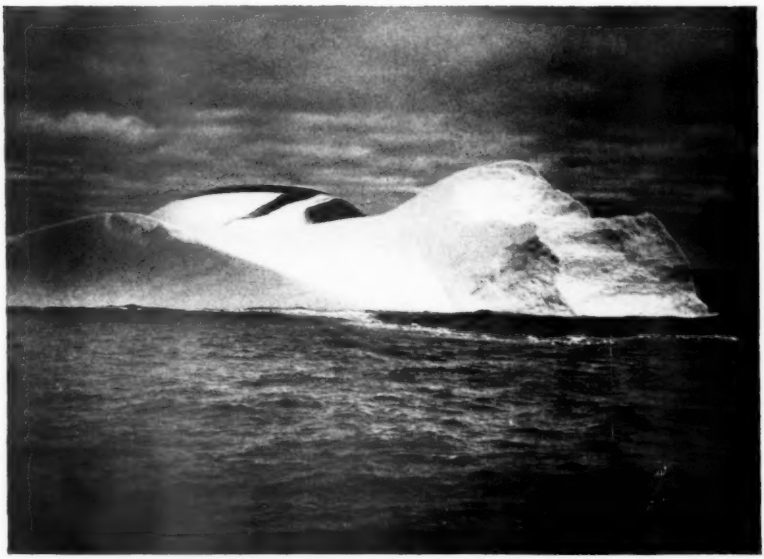
(*a*) True morainic, due to detritus collecting on the surface of the glacier or to material having been frozen in on the under side.

(*b*) Others where the material has been wind deposited. This might be the result of volcanic action over a wide area, or, more locally, may be the result of wind transporting material from bare rock surfaces.

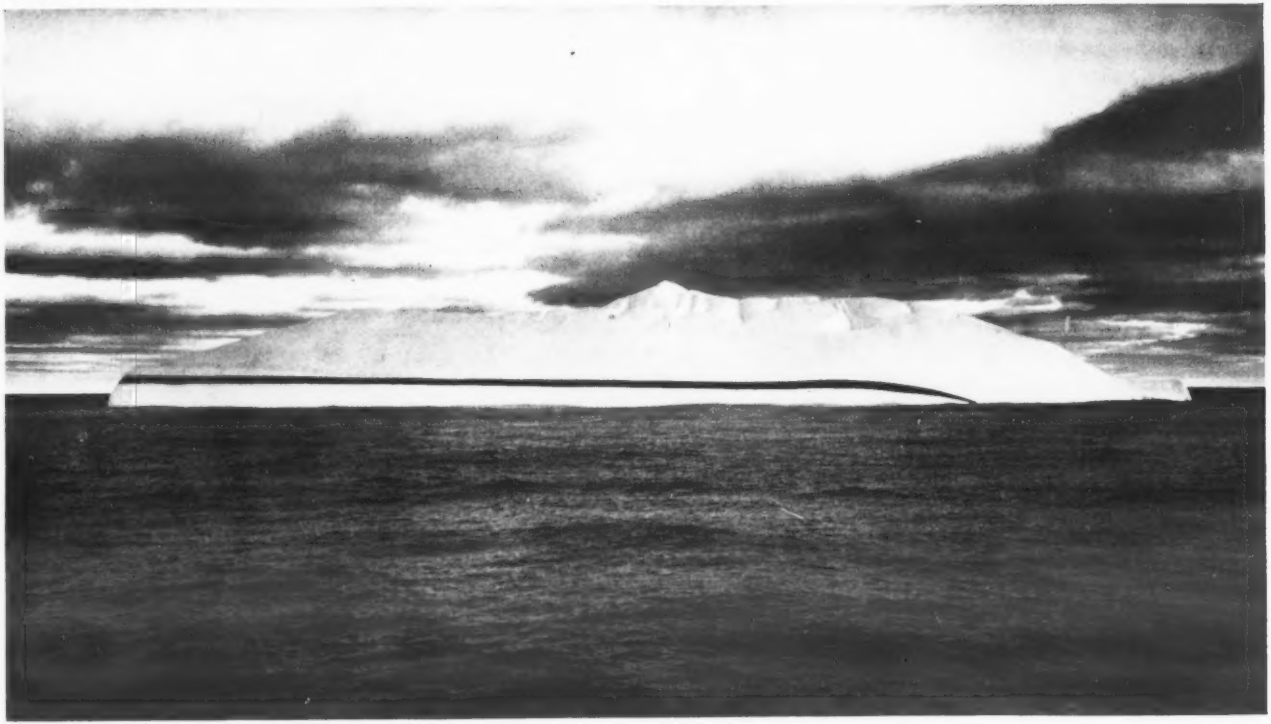
(*c*) Bottle-green bergs which may be a class by themselves, or merely a variety of (*b*).

In the experience of those working in the vessels of the Discovery Committee black and white bergs are comparatively frequent in the Weddell area between long. 16° and 51° W. One morainic berg (that reported on by Mr. Tipper, p. 428) has also been seen in the Bellingshausen Sea. It would appear significant that no reference to black and white bergs is to be found in Wright and Priestley's Glaciology, based on work done in the Ross Sea, and that Dr. E. H. Marshall saw none of them during the season which he spent with the Ross Sea whaling fleet. The *Discovery*, when under the leadership of Sir Douglas Mawson in 1930, reported black and white bergs from 55° 40′ E. and 56° 24′ E. A similar scarcity has also been the experience of the *Discovery II*, which has just completed a circumnavigation of the Antarctic: seven visits were made to the ice edge, and on each occasion some time was spent there. No morainic bergs were seen, and the only record is that of a bottle-green berg seen near the

6. Black-capped berg seen between South Georgia and the South Sandwich Islands



7. Another view of the same berg



8. Banded berg seen between South Georgia and the South Sandwich Islands

South Sandwich Islands on 25 November 1932 in 61° 32′ S., 40° 50′ W. We are almost forced to conclude therefore that morainic and similar bergs are more common in the Weddell Sea than elsewhere.

A feature of the last five years has been the number of reports coming from the South Atlantic and Weddell Sea of unusually large tabular bergs. That tabular bergs, originating from the break up of barrier ice, can be of great size has long been known. The *Erebus*, *Challenger*, *Nimrod*, *Terra Nova*, and *Endurance* have all in turn reported bergs over 20 miles long; it might almost seem therefore that on an Antarctic expedition there should always be a very fair chance of seeing at least one big berg. Large bergs have also at times been reported by commercial ships (apart from whalers) making passages generally but not always in high southern latitudes. Many of these reports from commercial ships however combine great lateral extent with a quite impossible height, and although some of the records are no doubt correct they must as a class be disregarded. Reports from whaling vessels are in a different category, and are regarded as reliable. In practice it seems only safe to rely on reports from ships which encounter bergs frequently, and whose records therefore are hardly likely to be distorted. We have confined ourselves therefore to statements made by whalers and expedition ships.

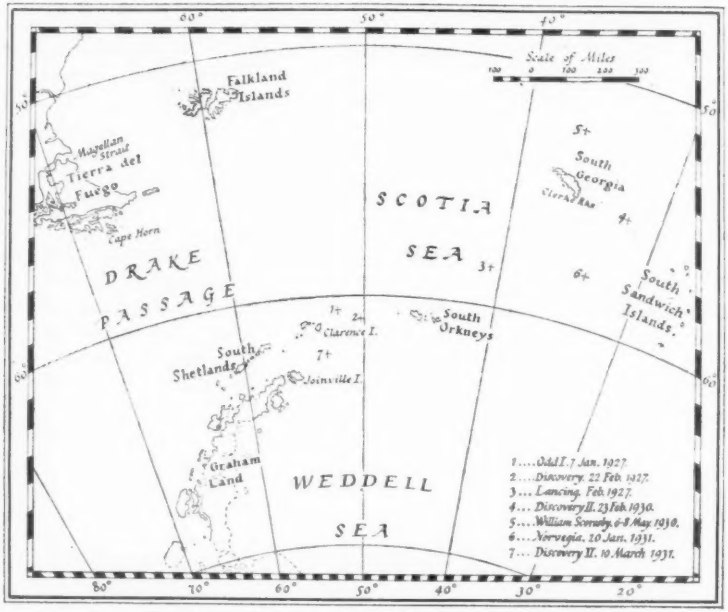
The first recent reports of large bergs from the Weddell Sea were received in 1927. A brief reference is made to these in the *Geographical Journal*, September 1927, p. 319. Since then equally large bergs have again been reported in 1930, 1931, and 1933, and the question arises whether their occurrence can be regarded as a usual feature or as something exceptional and pointing to big changes which must have taken place recently at the head of the Weddell Sea.

In 1927 the Norwegian whaler *Odd I* reported that on January 7 she steamed for nine hours at 10 knots along the north face of a tabular berg 100–130 feet in height. The position was stated as 60° 30′ S., 52° W., but it is not clear if this represents the ship's noon position or some part of the berg. The place in question is about 50 miles north-east of Clarence Island (see map).

In February 1927 the *Discovery* reported large bergs on two successive days. On the 22nd her noon position was 60° 48′ S., 50° 13′ W. She was then on the north side of a very large berg. The northern face of the berg was 35 miles in length, as measured by ship's log, and the ship's noon position was just a little west of the middle point of the side. The average height by sextant was 150 feet. Looking south from the north-west corner no limit to the length of the western side could be seen from the crow's nest. A sounding was made at 9 a.m. and gave a depth of 1373 fathoms. At midday, while a net was being towed, it struck bottom in an estimated depth of 600 fathoms. A second sounding at 3 p.m. only a couple of miles from the first gave 1011 fathoms. It seems almost certain that this berg was at any rate partially aground on the southern of the two ridges which have since been found between the South Orkneys and Clarence Island. On the more northerly ridge the least sounding so far obtained is 266 fathoms in 60° 10′ S., 50° 29′ W. It seems very probable that this was the same berg as that sighted by *Odd I*. The actual difference of

the *Discovery* position is 29 miles south-east of that of *Odd I.* The *Odd I's* position is evidently pretty rough, and nothing very exact can be said of the movement of the berg between January 7 and February 22. One would expect an easterly current, but the ridges may complicate the matter. Quite probably the berg had slewed round with its tail aground.

On February 23 the *Discovery* was off Cape Bowles, the south-west point of Clarence Island in 61° 25′ 30″ S., 53° 46′ 00″ W. The captain reported: "away to the southward the sea was crowded with enormous tabular bergs, one of which extended across the horizon and no limits could be seen to it." These bergs were presumably stranded in the shoal water which extends north-east from Joinville Island.



Positions of bergs seen by ships in the Antarctic

Early in February that same year the whaling factory *Lancing* reported a berg "as large as South Georgia"; the estimated centre of the berg was in 58° 30′ S., 40° 48′ W. This position is over 150 miles north-east of the South Orkneys, about one-third of the way towards South Georgia. (South Georgia is about 120 miles in length.)

In this connection the records of three trading ships in the autumn of 1927 may be quoted (with the qualification however that such records are not as reliable as those of whalers and expedition ships). The *Orita* reported a "berg, very large, about 10 miles long" in 43° 11′ S., 56° 20′ W. The *Winterhude* in 47° S., 52° W. reports "117 bergs sighted, one of which was about 10 miles long and rose about 150 feet above water." Both these records were made in

October 1927 and in the area between the Falkland Islands and the River Plate. A third record is that of the *Tijuca*, who in December 1927 in 36° S., 49° 20′ W. says "17 bergs in sight. Bergs in sight all the voyage S. Georgia to Buenos Aires. 5–17 December—one berg understood to be 50 miles long."

There are no reports of bergs of exceptional size in 1928 and 1929.

In 1930 on February 23 the *Discovery II* reported a berg at least 60–70 miles in length. It was found in the course of a passage from South Georgia to the South Sandwich Islands. The ship steamed eastwards along its northern side and the north-east corner was determined to be in 55° 07′ S., 32° 12′ W. The extreme westerly limit of the berg was not ascertained. The position stated is east-south-east of South Georgia, and about 40 miles beyond the Clerke Rocks.

The same year, on May 6–8, the *William Scoresby* was in 52° 08′ S., 36° 28′ W., and examined a berg 45 miles along a side (stated to be the "long side") lying south-east and north-west. The height was estimated at 180–200 feet. This position is over 100 miles north of South Georgia. There is every possibility that this is the same berg as that seen by the *Discovery II* in February. The line of movement agrees well with the currents; the distance between the two positions is 240 miles, and the time interval of sixty-eight days would give a travel rate, if the berg did not ground in the interval, of 3^1_2 miles per day in a more or less northerly direction. It is however almost certain that the berg did not travel in a straight line but must have moved with the prevailing current first to the north-west, then north, and then north-east, and on such a course both mileage and speed will be considerably increased.

The interval of three years makes it unlikely that the 1930 records apply to the bergs seen in 1927, for it is most improbable that the bergs reported in the earlier year remained aground to the south of Clarence Island for so long a time. The trading ship records north of the Falklands in the autumn of 1927 rather suggest that the bergs moved on immediately.

On 20 January 1931 the *Norwegia* reported a berg 40 miles long in 58° S., 34° W. This position is about 180 miles south-south-east of South Georgia.

On 10 March 1931 the *Discovery II* reported a berg whose western side was 20 miles, lying in a position approximately 62° S., 53° W. It was found therefore in practically the same spot as the "ice island" seen by the *Discovery* on the shoal ground south of Clarence Island on 23 February 1927.

There are no records of any very large bergs in 1932, but in February 1933 the *Discovery II* reported an iceberg 38 miles in length by 12^1_2 miles in breadth situated about 40 miles south of Clarence Island. This is in very nearly the same locality as the bergs seen in 1926 and 1931.

It will be seen therefore that three records at least refer to bergs on shoal ground near Clarence Island, and we have had to consider whether these indicate one berg only or a succession of big bergs stranding at this point. We think it most improbable that any berg, however large, will persist from one summer to the next, once it has got clear of the close pack-ice. The currents, which always have a northerly component, are strongest in the spring, and it is at this time, when the pack breaks up, that the bergs are set free. They are little affected by wind, and can move steadily through loose pack at right angles to the wind or even against it. If they ground on a shoal, such as that off Joinville Island, melting will before long reduce their draught, and they will

again travel onwards, soon to disintegrate in the heavy swells and warmer waters which lie to the north.

We conclude therefore that there were at least four, and probably six, very large bergs in the period concerned.

It appears from the records that no ship has done more than steam along one side. Though it would make a considerable demand on a ship's time, it would be a great advantage if a ship were to take the opportunity of steaming right round one of the big bergs and charting the lengths and relative positions of the different sides. This would be necessary in order to identify one berg with another beyond all possible doubt. Except for the possible case in 1930 there are no records of rate of drift of the very large bergs.

Whalers have worked round South Georgia for nearly thirty years, and it is only in the last few years that large bergs have been reported from this area In view of the occurrence of the large tabular bergs between 1927 and 1933 it seems necessary therefore to assume that there has been in recent years an unusual break up of barrier ice in the Weddell Sea.

When in 1927 the *Odd I* reported a 90-mile berg it was thought at the time that this probably represented the broken-off Stancomb Wills Promontory from Coats Land. The additional number of large bergs since listed indicates a much more extensive break up in the Weddell Sea, and obviously not confined to the Stancomb Wills Promontory. The place of origin must be either along Coats Land, at the Filchner Barrier, or on the unexplored western side of the Weddell Sea. The Coats Land ice-cliffs rise almost everywhere to high snow mountains, and that portions 20 miles long should break off and form tabular bergs is not considered possible; smaller bergs only are likely to form in view of the crevassed nature of the glaciers. The Filchner Barrier is described as low and about 60 feet in height. In the one case therefore the nature of the ice, and in the other the height, present difficulty in accepting either Coats Land or the eastern portion of the Filchner Barrier as the source of origin. It seems much more likely therefore that the bergs come from the unknown south-west portion of the Weddell Sea, between the Filchner Barrier and North Graham Land.

If, as we conclude, these large bergs have their origin west of the Filchner Barrier, the geographical changes taking place in that region must be of exceptional extent and importance. In the aggregate thousands of square miles of barrier have been removed, and the recession of the ice edge must be extremely rapid. The configuration therefore of this part of the Weddell Sea may have completely altered and produced results which markedly increase the chances of successful penetration into this unknown quarter.

FREDERIK HENDRIK ISLAND

H. GUERTJENS, M.S.C.

THE *Geographical Journal* of December last contained an article about "Frederik Hendrik Island" (vol. 80, p. 520). In this article it was stated that the Admiralty Pilot describes the island as " low, covered with a dense forest, and so marshy as to be almost inaccessible." In July 1931 Mr. F. C. Chichester crossed the island by aeroplane and "observed that the interior was flat and appeared to be covered with thick swampy grass, but a large area was laid out in raised strips of uniform width with what looked like deep drains between. At intervals deeper cross drains cut through at right angles. The whole appeared to be uncultivated and covered with high grass except in a few tiny patches of cultivated ground which had young banana plants. These were on the side of one of the long ridges. The accompanying photograph is made from the small negative, unfortunately much under-exposed, which had been placed at our disposal by Mr. Chichester. His local information was, that no white man had yet penetrated the island, and we cannot find in the Society's Library any account of any journey into the interior, though the coast has been charted. The structure disclosed by the photograph seems to show that at some time there had been extensive operations of agriculture, and we are glad to direct attention to the matter in order that if it is impossible to penetrate the island on foot it may be systematically photographed from the air."

It is true that Frederik Hendrik Island is still not much known; but if Mr. Chichester thinks that no white man had penetrated the island before July 1931 he is mistaken. I was not the first to do so, but I published in 1930, in *Onze Aarde*, a description of an exploration trip undertaken in November 1929 to this island. Since then other missionaries have also given narratives of similar journeys, and since the end of 1930 the R.C. Mission has been working in the island. Consequently it is not so impossible to penetrate this island as the writer of the above article considers. However travel is always very troublesome there owing to the very peculiar characteristics one meets in that country.

The easiest way of entering the island is from the Princess Marianne Strait. Along the coast it is much more difficult, owing to the small depth of the sea in which moreover extensive sand- and mud-banks are spread everywhere. Consequently if one does not know the channels which have been eroded in the strand by the small rivers it is impossible even for small vessels with a shallow draught to approach the island.

Although Frederik Hendrik Island is situated a little east of the present mouth of the mighty Digoel River, I still believe that one may safely assume that it is, or in any case was originally, a delta of this river. In such a land of mud and loam the coast-line is subject to continual alterations under the influence of sea and river-streams. The shoals, which are now like small islands, are only very little higher than the numerous sandbanks around the mouth, which are now washed over by the sea, but most probably they have also once been above the water-level at flood tide. On the map Frederik

Hendrik Island is indicated as one big island, with the much smaller Komelom close to it on the west. As a matter of fact, it consists of a numerous group of islands, of which the one situated most to the west is far the biggest. Except Komelom, where there is a single village, all these smaller islands are uninhabited, and they are raised so little above the water-level that at every flood tide they are washed over, for a great part, by the sea. In any case along the coast they are overgrown with mangroves and nipa-palms.

The largest island has, along the Princess Marianne Strait which separates it from the main island, a rather higher coast-line, where bamboo and jungle are found. But it is only a narrow strip; behind are interminable morasses, which are quite under water during the rainy season, and during the east monsoon become quite dry and form large reed and rush fields. In July, when Mr. Chichester flew above the island in his aeroplane, the water had no doubt already receded so far that the rushes and reeds were standing well above the water-level, and from above they must have looked like interminable grass-fields. Consequently he was right in saying "that the whole appeared to be uncultivated and covered with high grass." The water is carried to the sea or to the Princess Marianne Strait by numerous creeks which appear to be mighty rivers at flood tide during the dry season; at low water they shrink to insignificant ditches, enclosed between high walls of mud. They penetrate deep into the island, becoming narrower and narrower, but still appearing as open waterways in the grass-fields.

The villages, and here and there thickly overgrown mounds, lie distributed in the middle of the morass. The inhabited villages never get quite dry and are always surrounded by a wide circle of water. Most likely this is a measure of safety, so that an enemy can never approach or attack a village unseen. The water is regularly drained off by the creeks from the morasses and then evaporated by the sun, so that, in the dry season, when the water-supply is no longer replenished by rain, these extensive water-surfaces gradually become completely dry and only here and there deeper pools and fens remain. The natives can then no longer make use of their canoes, which are hollowed out of tree-trunks, for communication through their country. For their expeditions they are then, at any rate chiefly, dependent on footpaths. They make these by trampling a path in one direction or other, through the rushes and the reeds. As they never encounter any special obstacle on the marshy ground, these paths are generally trampled fairly straight. These paths have a double use, for they also become the channels for the canoes. The latter draw only a few decimeters of water. The paths form trampled channels in the soft earth, and only become navigable again when the water again becomes higher, so that there is sufficient deep water everywhere; the thick rush and reed growth still forms an impenetrable obstacle for the traffic, as long as the water-level does not reach to about their tops. Hence the paths also serve as the usual waterways through the thick grass-fields. The "drains" which are seen in the air-photograph may possibly be explained by this, at least partly, for they certainly do not occur in reality so close to each other and so regularly as they appear in the photograph. This picture reminds one of a view from a church tower in North Brabant over the surrounding arable fields. This is of course owing to the small photograph being "unfortunately much under-exposed."

Other black points or lines, which are sharply outlined against the green surroundings, are formed by fires. When the morasses are for the greater part dry, the grass-fields are set on fire along a long line before the wind. Fanned by the wind, the fire spreads very quickly through the dry helm grass, and the game are driven out before it, where the hunters have taken up their position and kill them with their arrows and lances. As during the east monsoon the wind is always steadily blowing in one direction, these burnt surfaces will most probably run almost parallel, but they will certainly also show very capricious shapes. The villages which are distributed about the morass are formed by a complex of small islands, which have been thrown up by the morass during the lowest water-level. Most probably a higher part of the land of a mound has been selected as a centre for such a complex. Consequently they consist of dredged mud, which is very fertile, and look like large oases in a great morass desert. They are chiefly planted with sago and cocoa-palms, bread-fruit trees, and bananas. Weeds and undergrowth grow rankly amongst them. The scantily spread higher mounds in the morass show a somewhat more developed vegetation, sometimes even cocoa-palms, which however have a very poor existence.

There are also some villages on the coast close to the beach, or a little farther inland. The land here however is so low that it is washed over by the sea-water in the small creeks, which penetrate far into the country. The sago-palm, which cannot stand sea-water, cannot therefore thrive here, and the *katella* is here the principal food for the population, which elsewhere is sago. The roofing, which elsewhere consists of thatching made of sago leaves, is here supplied by the *nipa* palm, which grows luxuriantly along the banks of the creeks. The coconut also does not thrive here, and yields only very small fruits. Here also higher mounds are found in the morass, where one encounters some small forests, but no bamboo, the otherwise almost universal growth in tropical regions.

Contrasting with the prosperous and luxurious impression made by the island-villages in the morass, the coast villages appear poverty stricken and wretched. The natives living in an island-kingdom in the morass have also an additional village in the higher edge of their country. During the rainy season the water often rises so high that the islands become uninhabitable. Then the inhabitants remove to the higher-lying forests.

On the islands the typical *baja*, the night sleeping hut, which looks like a great beehive, is found. The framework consists of a large bell-shaped construction, about 5 metres high and on the ground about 5 metres in diameter, formed of *gaba-gaba* sticks. This frame is covered with reeds and grass. Near the ground only is a small opening, through which the natives creep inside. When all the sleepers are in, this opening is also closed with a truss of reeds. They are then quite protected from the troublesome mosquitoes, those small torments which otherwise make sleep quite impossible. In the additional villages at the forest edge these *bajas* are not found. But there is plenty of firewood to make smoke-fires, and a thick smoke-cloud does excellent service as a mosquito curtain. On the islands one must be very economical with the wood, and the whole supply of wood is needed for the kitchen.

"The structure disclosed by the photograph seems to show that at some time there had been extensive operations of agriculture." Here appearances

will certainly be deceptive. This will readily be admitted when it is known that the population is still extremely primitive. They have not yet reached the stone age, for in their marshy little country stones are completely unknown and of course iron is also unknown. Sticks somewhat flattened, which do service as spades, are the only agricultural implement. And where there is no question even of barter and exchange "extensive operations of agriculture" can have no meaning. Indeed, if that "at some time" had only been a few years ago, the traces of it would already have been completely obliterated in such a tropical marshy country by the luxuriant vegetation.

Towards exploration by aeroplane I am rather sceptical at present. May these few details therefore satisfy those interested in the meantime.

For the better appreciation of Mr. Guertjens's interesting note we reproduce the photograph made by Mr. F. C. Chichester while flying across the island. It seems impossible to believe that the strikingly parallel structure shown in the photograph can be produced either by trampling or by fire driven before a constant wind. The parallelism is altogether too perfect. But the island measures some 4000 square miles, and there is perhaps plenty of room for the details photographed by Mr. Chichester and for those described by Mr. Guertjens. We shall hope for more information on this interesting problem.—ED. *G.J.*

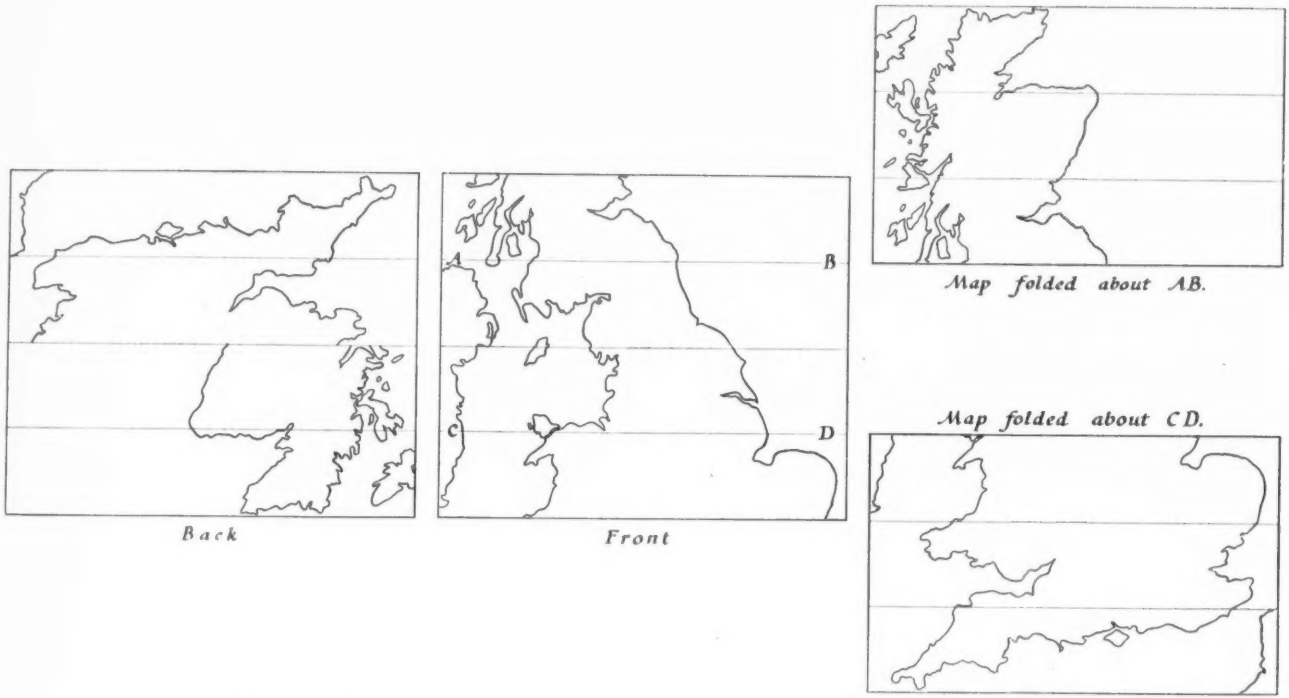
THE NEW ROAD MAP OF GREAT BRITAIN

ROAD MAP OF GREAT BRITAIN (FROM JOHN O'GROAT'S TO Land's End) showing Ministry of Transport Road Numbers and Classification. *Scale: 10 miles to 1 inch. Ordnance Survey* 1932. *In two sheets, each* 1*s. flat; dissected and mounted on the Ansell folding, in covers,* 6*s* 6*d*

THIS map deserves notice for several very different reasons, not all of them suggested by the title. It is the first general map of our country to show the Road Numbers which are now painted on signposts. The map is therefore indispensable to judicious drivers, and has plenty of interest to those who are not, but like to browse on a map, and on this to speculate why the Ministry have exalted one road and degraded another. Class I roads are shown red, but in two grades, Nos. 1 to 99 heavier than the rest, and No. 1, the Great North Road, in a grade by itself. In choosing the first hundred the Ministry seem to have looked ahead to the time when the new arterial roads about London are finished, and perhaps to have classified for commercial heavy traffic rather than for private cars. The private driver may rather seek than avoid the thin purple of Class II, which are mostly, if not all, perfectly good roads and quieter than the roads in red.

The map of Great Britain without railways, and with a light but effective brown hill shading, shows up very effectively which are the wilder parts of the country. The blue plate is a little pale; there are neither contours nor spot heights, these being among the "irrelevant detail" omitted from the "simple road map." But it is going a little far to treat as irrelevant those parts of France and Northern Ireland which come within the sheet lines. The explanatory leaflet within the back cover properly calls attention to the fully coloured layer map on the same scale which shows very much more detail, but not the road numbers; and remarks

Frederik Hendrik Island: the air photograph by Mr. F. C. Chichester published in the Journal for December 1932, and now reprinted to accompany the comments by Mr. H. Guertjens



The Ansell method of mounting maps as applied to the new Road Map of Great Britain

that this map can now be obtained folded and mounted on the Ansell method, which is such a pleasant and amusing feature of the Ministry of Transport map.

The Ansell method of folding was, we believe, patented long ago and used to some extent during the war. But it is only now employed for the first time by the Ordnance Survey in a public issue. The two sheets of the map are dissected and mounted on linen as in the figure. If you want the south of England you fold over along AB, or for the north of Scotland along CD. The method is good for a single map, or what may be treated as such. For a series it is clearly not well adapted. The only serious disadvantage of the plan seems to be that it requires the expensive dissection and mounting on linen. Dissection makes it difficult to measure distances accurately, and this defeats the nicer use of the grid, which is another important feature.

The new grid appeared first on the Plymouth sheet of the new 1-inch; we see it on the road map for the first time in its full effect, and can realize a little what it may mean to us to have at last a national grid; every point in the country having definite rectangular co-ordinates in a system which covers the country and will be the same on any sheet of whatever scale. There was no particular reason why this should not have been done before, because with a system of rectangular sheet-lines, such as the Ordnance Survey have always employed, the co-ordinates of the sheet corners on the Cassini projection must always have been known, and it would have been simple to give these figures as the French 1 : 80,000 has always done for the Bonne Projection centred on the Panthéon. Instead of that the Ordnance Survey sheets have, when "squared," had the squaring system particular to each sheet, and a reference has been made to square A 6 of sheet 161 for example. To appreciate the new grid we have first to realize that the grid is continuous, with no special relation to the sheet lines, which may be anything convenient; and second, that a grid reference is a pair of rectangular co-ordinates, not an indication of a particular square. It would be sufficient, though not convenient, to have on each sheet merely the co-ordinates of one point, and a knowledge of "grid north." For convenience the map is gridded with lines at some convenient round number of yards apart; and strong differences of opinion on the proper size of this square have a little obscured the fact that the critical decision was in the choice of the unit of length, not of the multiples which should be shown by lines across the map—the visible grid.

In an afternoon discussion some years ago "On the choice of a grid for British maps," reported in the *Geographical Journal*, vol. 63, p. 491, there were arguments for the foot, the yard, and the mile as the unit of length. For horizontal distances we are accustomed to think in yards or in miles. The British standard of length is the yard; but the Ordnance Survey have always done their geodetic work in feet. It is a useful approach to some orderly use of our units that they have made the national grid in yards; but it will take some training before we think naturally of Great Britain as being about 1,100,000 yards by 600,000. Perhaps it is wrong to try, or we may forget that the grid is not adapted for measuring large distances accurately, since it is in fact only the squared paper, so to speak, upon which the projection is plotted.

The change over from the time-honoured Cassini projection to the Transverse Mercator has not, it appears, made any visible difference in the outline of the 10-mile-to-the-inch map: its benefits are more recondite, being largely in convenience of calculation, especially of bearings, in survey for artillery. In civil use its great advantage will be the invariable grid reference.

THE MOUNT EVEREST EXPEDITION

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THE news from the Mount Everest Expedition is contained in reports sent by the leader, Mr. Hugh Ruttledge, to the *Daily Telegraph* and is by them distributed. The following article is based upon the information contained in the reports and therefore bears the above legend.

On February 9 Doctor Raymond Greene and Mr. F. S. Smythe left Victoria Station to join s.s. *Viceroy of India* when she sailed for Bombay on February 10, the date on which Mr. Ruttledge reached India in s.s. *Comorin* with Messrs. Crawford, Brocklebank, Longland, Shipton, Wager, and Wyn-Harris. Both parties went on at once to Darjeeling, where they were joined by Doctor McLean, who had recently come from Palestine, by Major Hugh Boustead, and by Captain Birnie, Mr. Shebbeare, and Mr. Wood-Johnson, who were already in India.

Before leaving England Mr. Ruttledge had intended to keep his whole party at Darjeeling from March 1 to 15. But it would appear that they acclimatized to that altitude and to the other local conditions more quickly than he had expected, and it was decided to start earlier and advance by easy stages over the first part of the march. By March 6 the seventy-two Sherpa porters had been collected and had been blessed by the head Lama of Ghoom; and an advance party consisting of Crawford, Brocklebank, Longland, McLean, Shipton, Wager, and Wyn-Harris started for Kalimpong, where they would spend a short time rearranging the stores. Mr. Ruttledge with the rest of the party left on March 8, seventeen days earlier than the date of the departure of the 1924 Expedition.

At Kalimpong Mr. Ruttledge's party was joined by Lieutenant Thompson and Lieutenant Smijth-Wyndham, of the Royal Corps of Signals, whose duty will be to erect and operate the wireless apparatus which is intended to receive weather reports from the Indian Meteorological Office.

In the *Journal* of February it was stated that the party might follow the direct route from Gangtok to Kampa-Dzong over the Serpo La. We learn however that they chose the longer route by Pedong, Natang, and the Chumbi Valley, probably because it appeared from local reports that it was too early in the year to cross the Serpo La with a heavy baggage train.

About March 18 the second party must have crossed the Jelep La and descended into the Chumbi Valley, for from Yatung Mr. Ruttledge sent a dispatch to the *Daily Telegraph* dated March 22. The two parties must then have been very close together and should have joined forces at Gautsa. Together they would go forward to Phari Dzong on the edge of the Tibetan plateau.

If they left Phari on March 26 they should, judging by the speed of march of the expeditions of 1922 and 1924, have reached Kampa Dzong about March 31: have arrived at Shekar Dzong by April 12 and Base Camp by April 20, about seven weeks before they may expect the monsoon. It is quite possible that since the party is larger than it has been before the march may take longer, but in any case the early start should allow the men to acclimatize themselves slowly to the altitude and save them from the tiring necessity of having to establish the mountain camps without reasonable intervals of rest.

PHOTOGRAPHIC SURVEYS

WISSENSCHAFTLICHE ERGEBNISSE DER ALAI–PAMIR EXPEdition, 1928. Edited by H. v. FICKER and W. R. RICKMERS. Teil I. Geodätische, topographische und glaziologische Ergebnisse. By RICHARD FINSTERWALDER. Band I. Geodätischer und glaziologischer Teil. Band II. Kartenbeilagen. *Berlin: Dietrich Reimer / Ernst Vohsen* 1932. $10^1/_2 \times 7^1/_2$ *inches;* vi + 218 *pages; illustrations and maps. Two volumes M.*78 (*bound M.*84)

THE Alai–Pamir Expedition of 1928 set out under the leadership of Dr. W. R. Rickmers to explore and map the mountain ranges of north-west Pamir, including the completely unknown Seltau and Transalai, in their geographical, geological, physiographical, and glaciological aspects. Previous publications have given a general idea of the methods and of the results achieved during their strenuous expedition. The present publication is part of a complete account of the scientific results published for the Notgemeinschaft der deutschen Wissenschaft; it is a beautifully prepared and printed volume.

It would not be easy to imagine a country more alarmingly difficult to map than the terrain covered by the expedition. The mountain ranges rise from a high plateau to heights of 15,000 to 20,000 feet. Enormous glaciers, one of them the largest known outside the Arctic regions, run in great highways through the country in a way reminiscent of East Greenland, but quite unfamiliar in Alpine scenery. The straightforward difficulties of transport and climbing were exaggerated by difficulties with the porters. Finsterwalder and Biersack, each armed with a specially light phototheodolite, worked two parties which together in the course of a single summer observed from 350 points, and brought back 250 pairs of photographs from which a map could be plotted. The result was 15,000 square kilometres plotted on a scale of 1 : 200,000, out of which two large special sheets could be published at 1 : 50,000. The map-making carried out by Dr. Richard Finsterwalder is likely to stand as a classical example of good fieldwork, much as the work of his father, the Geheimrat Dr. Finsterwalder, endures as theoretical photogrammetry.

The probability that future Himalayan expeditions may include such map-making in their programme makes it interesting to examine the technical factors involved. Dr. Finsterwalder had only one skilled assistant, and he worked independently. The surveyor himself had to be prepared not only to work the station but to make the final and difficult stages of the climb alone. This was possible, even if undesirable, where the complete equipment of the phototheodolite (the Zeiss special light) weighed only 30 lb.

Survey work on an expedition means that triangulation and topography must be carried on at the same time; there can be no going back, no climbing the same mountain for a second time. Photogrammetrical apparatus is particularly well adapted to this double function, especially so in the case of the phototheodolite under discussion, in which the camera objective is simultaneously the telescope objective. But the difficulty with photographic surveys is that the very precision that can be derived from the photographs makes unusually severe demands on the precision of the underlying trigonometrical framework. Dr. Finsterwalder sets this forth as the greatest disadvantage of the procedure.

To the photographic surveyor in the field the problems of securing the topography of his district dwindle to a negligible quantity beside the problems of his framework. The one is little more than a matter of taking photographs from a good base. But neither good photographs from a good base nor photographs from a fully equipped aeroplane are of any value without a widespread system

of ground control. This other problem, the trigonometrical network, may be approached in two ways. One way is to construct an instrument with the minimum precision necessary for a given technique. The other is to take a precise instrument and invent a technique that makes the best use of it.

Finsterwalder used the former method. With his camera-theodolite the angles could be measured only to a minute of arc, which though adequate for the method of triangulation, necessitated a complicated procedure in the measurement of photogrammetric bases. One feels that in the future one would be more likely to tackle the problem from the other side by using the second of arc precision of a modern mountain theodolite. This would probably increase the weight of the equipment to 45 lb., thereby making it necessary that at least one porter should be able to reach the highest stations. But once at the station, the procedure would be more rapid and more fruitful.

Progressive triangulation of an unfamiliar district is difficult. The author urges the value first of sun-azimuths and secondly of photographs of known orientation as aids to the identification of doubtful points. The further assistance secured from stereoscopic pairs, where mountain masses lie one behind the other, must have been used by the author, though it is not mentioned.

The plotting of the photographs was done on an old Zeiss Stereoautograph of 1911. If the control is good, the most modern equipment for plotting is not necessary.

The book is an exact account of the work in all its aspects. There are discussions of the errors in final work, consequent on given errors in field-work, that are of general value in survey theory. Not only the actual results but many suggestions make it indispensable to any one intending to carry out precise survey work under expeditionary conditions. The published map itself suffers from being a not very happy attempt at the delineation of hill-features by means of shading. But cartographers who know the difficulties will refrain from unsympathetic criticism. An account of the glaciology of the region based on precise measurements of slope and rate of flow is appended. The values were determined photogrammetrically. Perhaps the most interesting conclusions are the apparent confirmations of Lagally's formula for the depth of a glacier, given the slope and speed; and of Gripp's observations on the exceptional thickness of a glacier immediately before the tongue.

It is instructive to contrast the principles of this important work with those enunciated or implied in the treatise by Captain M. Hotine, R.E., 'Surveying from Air Photographs,' published in 1931 by Messrs. Constable and Co.

Dr. Finsterwalder, for instance, writes:

"The principal advantage of photogrammetric procedure lies in the fact that by means of an automatic plotting apparatus it is possible to reproduce the landforms as continuous and exactly drawn contours. Other methods, on the other hand, . . . only permit a reconstruction of the landscape point by point, whereby a precise map, at least as far as expeditions are concerned, hardly comes into question."

Captain Hotine, faced with the same generalization, states :

"The usual procedure in a ground survey, whether for mapping or for any other economic purpose, is to fix a certain number of positions, or to secure a number of identifications and to interpolate the remainder by sketching, by inference or even by guesswork. An air survey, on the other hand, fixes or identifies all the detail relatively and utilizes ground control to render the data absolute and to check any doubtful points."

In the latter case the alternatives presented are ground survey and air survey. But the correct opposition is between survey with and without a camera. The

flying machine is in most cases the most rational means whereby the camera may be brought into an advantageous position or series of positions; from the photographs we may, according to our technique, prepare a map with as little interpolation as we please. But there is nothing to prevent a surveyor preparing a map from an aeroplane in exactly the same way as others have from the back of a camel, namely, with compass and sketching-board. It may be the only way of preparing a map of an extended region, and indeed this method produced in the summer of 1932 a fine map of 7 degrees of the east coast of Greenland on the scale of 1/M.

If a camera is available it is not the simplest thing in the world to use it or its results to advantage. The elementary aspects of the matter will be found clearly set out in Captain Hotine's book. The kind of difficulties that can arise are there recalled by the experiences of a recent British expedition to the Arctic. In order that the aeroplanes could be used to advantage, the surveyors made inquiries of the authorities, who supplied them with a little information and two cameras. In spite of a certain crudity in the construction of the cameras, the leader of the expedition trained himself to change plates with great rapidity and was rewarded by the finest existent series of photographs of those regions. But the next step—how best to make use of the photographs—had never been very clear from the start. For the type of aerial survey where measurements are taken from the photographs these photographs were invalid, because in such an old type of camera it was impossible to reconstruct the relation of plate to lens. The next most valuable property of the photographs was to be obtained by examining them pair by pair in a stereoscope. But the surveyors did not realize the opportunity they had of getting an impression of the relief of the coast by means of the three-dimensional model seen in the stereoscope. The methods by which a map is extracted from the visual model are various. Captain Hotine is preoccupied with the Arundel Method ('Mapping from Simple Stereoscopic Pairs,' Chapter IX). Originally developed by the Geographical Section of the General Staff some years ago, its technique is now advanced and refined. Detail is plotted graphically, as on a plane-table, by the intersection of rays from two stations. The two stations are the Principal Points of two successive vertical photographs; the assumption is that directions from these points are accurately enough equivalent to those which would have been obtained on a plane-table set up on the ground at the respective points. To draw contours a network of spot-heights is required. These must either be obtained in the field or provided by the stereoscopic examination of the same pair of photographs in the Fourcade Stereogoniometer. The contours are interpolated between these spot-heights with the help of the Parallactic Grid, a network of lines engraved on glass-plates which can be made to appear to cut the model in a horizontal plane at any desired height.

This is the kernel of the "simple approximate methods of detail plotting," of whose perfection the author is, with some justification, proud. It is a method which makes especially good use of the facilities available to a military survey. By the fact that its operations can be divided over a number of men, it can when necessary be carried through very quickly. But it demands first-class photography preferably from a gyro-stabilized aeroplane; and its further development appears in the sentence: "a usual organization in plotting from air photographs is to place six men in a row in the same room." The end result is a map that is good but not of the high degree of precision which is implicit in the photographs. Considered as one of various methods of plotting this is perfectly satisfactory. Occasions are likely to arise when accuracy must be sacrificed to speed and convenience. It is only disquieting when presented as a standard method to the

exclusion of others and to the exclusion of mechanical plotting. The method could seldom be applied to the work of an expedition, because the photography would be too irregular. For the sheet-by-sheet mapping of a large civilized territory the contouring would be inadequate. Nor is it suitable for cadastral surveys.

The alternative method of mechanical plotting is persistently depreciated by Captain Hotine. The governments of France, Germany, Russia, Italy, Switzerland, Spain, Holland, Denmark, Hungary, and Austria—to mention known cases—are all using machines which in his opinion are at the best only approximately correctly built. In spite of new frontier surveys in France, of the geological surveys in the United States, of the new topographical survey of Switzerland, and of Danish and Norwegian surveys in Greenland, the author in the last chapter condemns one by one the machines which carried out the work.

The mechanical plotter is a machine of fantastic possibilities, many undiscovered, and many especially to the advantage of the exploratory surveyor. Some of its applications, amongst them the whole of cadastral survey, have not come within the scope of Captain Hotine's treatise: photogrammetry from ground stations, being no branch of air-survey, is automatically excluded. But with Mason's work in the Shaksgam and Finsterwalder's in the Alai–Pamir before us it cannot be dismissed as insignificant. It may in fact be found later that in certain types of country ground photogrammetry combined with survey from the air will be a normal procedure. M. A. S.

REVIEWS

EUROPE

OXFORD: ITS PLACE IN NATIONAL HISTORY. By Sir JOHN A. R. MARRIOTT. *Oxford: Clarendon Press* 1933. 7×5 *inches;* viii+206 *pages; illustrations.* 6*s*

This is a history of England illustrated by the story of Oxford and therefore has a somewhat different point of view from such a book as Andrew Lang's 'Brief Historical and Descriptive Notes' (strangely omitted from the short bibliography in the present volume) which deals rather with Oxford as affected by English history. The Romano-British period is a blank; "the authentic history of Oxford dates from the advent of the Saxons. . . . The origin of English towns may, as a rule, be ascribed to one of four reasons: geographical, ecclesiastical, economic, or strategic; . . . in the case of Oxford all four combined to attract people to this favoured spot." The importance of its central position, which was at the same time not very far removed from the capital, is pointed out, and the reasons for the establishment of a university here are admirably stated. Then follow descriptions of the long series of " 'movements' which profoundly influenced the English people and the whole English-speaking world." It is shown that the collegiate foundations, especially those of the sixteenth century, "correspond to the national mood of the moment"; Hertford College alone has no mention. The story is brought down to the imperial foundations of Cecil Rhodes and to the internal reforms of Lord Curzon and their interruption by the Great War, which was followed by the Commission of 1922 and the admission of women to the university.

The author gives an appendix of notes, in some of which he qualifies a definite statement made in the text; for instance, after remarking that King, the first Bishop of Oxford, "removed to the stately building which still stands in St. Aldate's," he notes that the date of this house makes its association with Bishop King legendary. A suggestion may be offered that the house was built by his great-nephew and heir, John King, Dean of Christ Church, afterwards Bishop of London, or possibly by that Bishop's son, Henry King, Canon of Christ Church and Bishop of Chichester.

One or two slips require correction. The author surely intended to write that Cardinal Pole followed Queen Mary to the grave within twelve hours, not twelve months. It was Brentford, not Brentwood, that Prince Rupert captured in his advance from Colnbrook to Turnham Green. As Queen Mary II was the daughter of James II, it is strange to speak of William and Mary as succeeding "their uncle," true though it is of William. The index is very far from perfect. The illustrations are good, but there is nothing very novel about them. J. H. R.

THE SEA FISHERIES OF GREAT BRITAIN AND IRELAND. By GEORGE LOWE ALWARD. *Grimsby: Albert Gait* 1932. 10×7½ *inches;* xxiv+474, 12, *and* 56 *pages; illustrations and charts.* 21*s*

Mr. Alward has produced this book in his eighty-eighth year. He was skipper of a trawler at nineteen, had twenty years' sea service and sixty-five years' intimate connection with commercial fishing. Add to this that he has always recognized the value of marine research to the industry and in the early stages of fishery investigation in England rendered them material assistance by the collection and communication of data as to the operations and success of the boats employed, and it will be seen that he is in an unusually good if not a unique

position to record and discuss British fishing during a long and critical period. Practically the book covers the nineteenth century. It sees the spread of trawling northwards from Dover until by successive stages the whole North Sea was brought under the trawl, the change from sails to steam as the predominant motive power, the introduction of the use of ice, first collected locally, then imported, and finally manufactured. The progress was attended by the growth of the landings in Great Britain of fish of British taking, excluding shellfish, to well over 1,000,000 tons.

While other fishing methods are not neglected the book is concerned mainly with trawling. As a loyal son of Brixham Mr. Alward inclines to the view that Brixham rather than Barking was the birthplace of modern trawling, in which he differs from many of the writers who have examined the history of this matter, but his experience has enabled him to set out what probably is the real explanation of this difference, namely, that the two developed somewhat different grounds: and unquestionably as soon as the use of steam made ready access to coalfields of prime importance the future lay in the hands of the Devon and Kentish men who had settled in the Humber rather than in those of the Barking fleets based on Gorleston. It is interesting to note that for a time the vessels of the various nations working the North Sea fished side by side in amity, even in some measure of co-operation. To the present writer's knowledge this was far from true of the early seventies. Interesting if discursive accounts of the development of the chief English ports are given, and that of the development of Barking is perhaps particularly welcome because previously so little known.

The book concludes with the reproduction of the entire report of the Ministry of Agriculture and Fisheries for 1930. To publish an appendix of fifty-five pages already before the public is a courageous measure; but it enables readers who would not be likely to meet the Report otherwise to inform themselves of the importance and wide diversity of modern English and Welsh fisheries, and of the efforts now made to understand and to develop them. The volume closes just before the introduction of the oil engine, the factory ship, and the growth of brine freezing. It may be recommended to all those interested in the growth to maturity of the national fisheries and the craft by which the growth was carried out, provided they are prepared to bear patiently with a good deal of repetition and some diffuseness. J. O. B.

DAS GEBIET DER FREIEN HANSESTADT BREMEN in 28 Kartenblättern nach den Originalaufnahmen JOH. GILDEMEISTERS und C. A. HEINEKENS. Edited by Dr. HANS DÖRRIES. *Bremen: G. Winter* 1928. 17 × 12 *inches;* 18 *pages; maps*

Although this portfolio of reproductions, recently presented to our Society by the Editor, was published in 1928, it is of sufficient importance to warrant its being brought to the attention of students here. It contains reproductions, mostly on a slightly smaller scale than the originals, of the maps of the Free State of Bremen issued by C. A. Heineken between 1790 and 1806, twenty-eight sheets in all. For some years Heineken had been collecting existing cartographical material and carrying out plane-table surveys. He then obtained the co-operation of J. Gildemeister to triangulate the area, who, using 10-inch and 5-inch Troughton reflecting sextants, fixed one hundred points trigonometrically, and linked the survey to that of Oldenburg. This was the first accurate trigonometrical survey of the district, and was not superseded until 1890. From this material was compiled the general map of Bremen published in 1798, and, revised in 1806, on a scale of 1 : 41,000. Heineken also issued from time to time larger scale sheets, ranging from about 1 : 3080 to 1 : 20,000. These show the holdings

into which the land was subdivided, the uses to which it was put, and the tenants' and owners' names. They are therefore of interest not only to cartographers, but to economic geographers and historians. G. R. C.

RUMANIA: its history, politics, and economics. By GEORGE CLENTON LOGIO. *Manchester: Sherratt and Hughes* 1932. 9 × 5½ *inches; 208 pages; sketch-map.* 6*s*

This vigorously written book gives much information on the internal administration and economics of Rumania and provides a useful supplement to the formal treatment of the country given in purely geographic works. The author evidently knows the country well, and apart from the historical summary which forms the first part of the book, is dealing with matters which he has observed at close quarters. He maintains the thesis that Rumania is a good country badly run, its backward condition, it is alleged, being due to the exploitation of a hard-working but ignorant peasantry by administrators who inherited their methods from the Phanariot Greeks, to whom the country was farmed out by its former Turkish rulers. The subjects dealt with include an examination of the agricultural, industrial, and fiscal policy of recent governments, the question of the new provinces and their minorities, and a detailed investigation of the difficulties in the way of developing the country, including the need for improving the civil service, of reorganizing education, of attracting foreign capital, and so on.

Unfortunately the book is marred by some instances of careless writing or proof-reading, the most glaring being the statement that the area of Rumania is "approximately larger than that of Italy," but apart from such slips the work is of much value and interest in giving, if not a dispassionate, at least a vivid account of present-day Rumania. M. R. M.

ASIA

HAZARDS OF ASIA'S HIGHLANDS AND DESERTS. By WALTER BOSSHARD. (Pioneer Series.) *London: Figurehead.* [N.D.] 8½ × 5½ *inches; 138 pages; illustrations and sketch-maps.* 5*s*

The author of this little book accompanied the late Dr. Emil Trinkler on his expedition through Eastern Ladakh to Central Asia in 1927–28, and kept on that journey "a diary with pen and camera," not with the intention of presenting his observations to a critically inclined public, but solely in order that he might be able to communicate his impressions and experiences fresh to a restricted circle of friends. The book is therefore no more than it claims to be, impressionist and light, but interesting. Dr. Trinkler has already written a more substantial popular account which has been translated into English, and the scientific results have been published in two fine volumes by his widow and Dr. de Terra. There is therefore nothing new in M. Bosshard's story, though it is related with charm and understanding. Troubles for a scientific expedition in China are many, and in Sinkiang more than elsewhere. Dr. Trinkler's expedition took place during the restless period which culminated in the assassination of the strong Governor-General, Yang-tsen-hsing, since when obstruction and broken promises have become more than ever the rule.

M. Bosshard, responsible for many of the practical details of the Trinkler expedition, treated his troubles patiently and philosophically for another five months after Drs. Trinkler and de Terra had returned by the Karakoram pass to India; but when at length he was allowed to leave Kashgar and reached the Russian frontier, he sees his experiences in Sinkiang reflected in the weather of his last day there: "In the morning the sun rose splendidly over the mountains,

while the fog floated like a sea of clouds in the valley. At midday came the snow, and after this an ice-cold wind which whipped up the ice-needles into my face. And in the evening there were grey, troubled clouds in the sky, with a few bright strips between." K. M.

TWENTY YEARS IN TIBET. By DAVID MACDONALD. *London: Seeley, Service & Co.* 1932. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 318 *pages; illustrations and map.* 18*s*

This book is nominally an account of the comings and goings of people through the Chumbi Valley, and as this is the main and most important route between India and Lhasa, and Mr. Macdonald was British Trade Agent from 1905 to 1925, he has met all the interesting personages that have passed through this valley. The period about which he writes was one of special interest and unusual activity on the north-east frontier of India and covers Colonel Younghusband's Mission to Lhasa in 1904, the flight of the Dalai Lama in 1910, his return to Lhasa in 1912, the expulsion of the Chinese from Tibet, and many other events of historical interest. In fact his account is almost a short history of Tibetan politics during the past twenty years. Mr. Macdonald was in an exceptionally fortunate position, as the circumstances of his birth gave him a peculiar sympathy with and understanding of the Tibetan people and their country, and he is able to give an intimate description of Tibetan ways and customs. His extraordinary knowledge of the language, and especially of the honorific dialect, enabled him to form friendships with the Tibetans of all classes from the highest to the lowest, including the Dalai Lama and the Tashi Lama; his account of the flight of the Dalai Lama closely pursued by Chinese troops is most dramatic.

The book is well illustrated with photographs and will be read with interest by those who desire to know something about the inner life of a most interesting people. C. H. B.

THE NEW CONQUEST OF CENTRAL ASIA: a narrative of the explorations of the Central Asiatic Expeditions in Mongolia and China, 1921–1930. By ROY CHAPMAN ANDREWS; with chapters by WALTER GRANGER, CLIFFORD H. POPE, NELS C. NELSON. (Natural History of Central Asia. Vol. I. Editor: CHESTER A. REEDS.) *New York: The American Museum of Natural History* 1932. $11 \times 8\frac{1}{2}$ *inches;* $1+678$ *pages; illustrations and maps.* $10

This bulky volume presents in narrative form the adventures, travels, and discoveries of the largest and most highly organized land expeditions which have ever embarked from the United States of America. It covers ten years of work and five seasons in the field. The cost was over 600,000 dollars and the European staff comprised thirty-four experts, of whom five were topographers. It is most readable, though perhaps English readers may be shocked to find such terms as "stepping on the gas" in the text; and if no attempt has been made to classify the valuable collection of material and knowledge brought home, the book is necessary as an introduction to the scientific monographs which are to come. The three maps at the end of the volume scarcely do justice to the expedition, but we are promised the completed and detailed maps in a later volume.

The value of this book is not strictly geographical. Notes on zoology, palaeontology, and topography are scattered throughout the book, together forming a fine picture of the whole object and results of the expedition. The difficulties of the topographers are well exemplified by the account (p. 293) of the survey of a mirage with its lake and hills, in the belief that it was in fact what it looked like.

Part I deals with the Mongolian Expeditions in which a fleet of Dodge cars take a leading place and without which such great distances could never have been traversed in the time, for the penetration of Central Asia reached beyond

long. 98° 30′ E. But perhaps the outstanding feature of the book is the importance and success of correlated scientific work in the field. Its value is amply proved. Zoology, botany, palaeontology, and topography were all brought into contact over a single specimen, and for that Dr. Andrews must take full credit. The genesis of the expeditions dates from Professor Osborn's prediction in 1900 that Asia would prove to have been a great dispersal centre of northern terrestrial mammalian life, and the remarkable fossil discoveries appear to have amply justified the contention. The discovery of the Baluchitherium (pp. 138 *et seq.*), of the Shovel-toothed Mastodon (Platybelodon), together with a fossil foetus (p. 144), and of some fifty eggs of more than one species of Dinosaur at the now famous Flaming Cliffs of Shabarakh Usu, are among the most sensational and are of world-wide interest. The whole of those ten years' work have been a marvellous triumph of organization, inspired by Professor Osborn and carried out by Dr. Andrews and his staff.

The expedition was not all plain sailing. Climatic difficulties—and Mongolia can be most exacting—Mongolian suspicions, and the dangers of Red Russian penetration into Central Asia, were all dealt with and overcome. Not so the jealousies of the Chinese, and though the very one-sided demands of the Commission for the Preservation of Ancient Objects in China (p. 420) nearly wrecked the final phases, we must remember that the country in which the expedition worked was China, and who would not envy a foreigner finding fifty Dinosaur eggs and transporting them to his own country?

Part 2 deals with explorations in Shensi, Szechwan, and Hainan. Part 3 is a review of the expedition's work and includes an indication of future problems to be solved in Central Asia. The work is profusely illustrated with excellent photographs, and there is a good index. R. M.

POGRANICHNAYA DJUNGARIYA [FRONTIER DZUNGARIA]. By V. A. OBRUCHEV. Vol. III. [Geographical and Geological Description.] Part I. *Leningrad: Academy of Sciences* 1932. 10×7 *inches;* 312 *pages; illustrations.* 6 *roubles* 50 *copecks*

After a long interval, due to the Revolution and the inability of the Tomsk Technological Institute to continue bearing the cost of publication, there has been issued, this time by the Academy of Sciences at Leningrad, another instalment of the account of Professor Obruchev's journeys undertaken in the years 1905, 1906, and 1909. It may be useful to note the scope and dates of the previous issues: a petrographical study by M. A. Usov appeared in 1911 and formed vol. ii, part 1, with 429 pages and 16 plates; the diaries of the journeys, including all the observations, were published in 1912, 1914, and 1915 in three parts, forming vol. i, the first part being accompanied by two maps compiled by the Professor's son, S. V. Obruchev, with explanatory notes and an index of names. The geological work is proceeding and will form part 2 of vol. iii. The present part is devoted to bibliography, orography, and "hydrography," *i.e.* the river-systems. Unfortunately it is entirely in Russian; but a geographical and geological sketch entitled "Das Tor nach China" appeared in the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1923, pp. 241–265. The specimens of fossil flora were sent to London to Professor A. C. Seward, who described them in English under the title "Jurassic Plants from Chinese Dzungaria collected by Professor Obrutschew," in the *Mémoires du Comité Géologique, St. Pétersbourg*, 1911, *Nouvelle Série* 75, pp. 31–61, 7 plates.

The excellent bibliography, occupying 86 pages in the present volume and arranged in chronological order, contains 173 items, though, strangely enough, not the last named. Most of the works are in Russian, but there are some in

German and two or three in French and English. Each entry is accompanied by a few lines summarizing and criticizing the contents; in the case of Carruthers's 'Unknown Mongolia,' 1913, the summary runs to one and a half pages. The second part of the book, dealing with physical geography, is divided under four main heads: (1) a general survey, (2) the uplands, (3) the lowlands, and (4) the river and lake systems. The illustrations are somewhat spoilt by being printed on the same rather poor paper as the text. The Society is indebted to the author, one of its Honorary Members, for presenting this volume to the Library.

J. H. R.

THE ANDAMAN ISLANDERS. By A. R. RADCLIFFE-BROWN. *Cambridge: University Press* 1933. 9×5½ *inches;* xiv+510 *pages; illustrations and maps.* 30*s*

This book is a reprint of the first edition of 1922 with the addition of a preface and a chapter on the languages of the Andaman Islands. It is a pity that it has not been rewritten and revised and notice taken of the new facts recorded in the Census Report of 1931. Mr. Man is dead and unable to explain and justify his attitude, but the facts recorded by him as contrasted with the material collected by Professor Radcliffe-Brown afford excellent foundations for tracing the modifications suggested by a deeper acquaintance with and knowledge of the culture of the Settlement, a valuable line of approach. Professor Radcliffe-Brown acknowledges that "later work in other culture regions would lead me to restate in somewhat different terms what is here written, particularly in the sixth chapter on myth." What is wanted and what Professor Radcliffe-Brown is well equipped to give us is a matured and revised statement of the arguments so cogently presented in Chapters V and VI which are of the highest value to students. The chapter on the Andaman languages is useful, but here again it is to be regretted that he has not given us a statement of his views on the methods of classification employed in these languages as recorded by Sir Richard Temple in the Andaman Census Report of 1901, p. 111.

T. C. H.

LES OISEAUX DE L'INDOCHINE FRANÇAISE. By J. DELACOUR and P. JABOUILLE. *Paris: Exposition Coloniale Française* 1931. 11×7½ *inches.* Tome I, lvi+280+xlvi *pages.* Tome II, 340+lxii *pages.* Tome III, 348+lxxiv *pages.* Tome IV, 296+lxvi *pages; illustrations*

French Indo-China was for long a forbidden country, and but little known either geographically or ornithologically, for it was not until 1858 that the French conquered Cochin China and commenced the formation of what is now a vast empire, consisting of the Colony of Cochin China with Saigon as its capital, and the protectorates of Annam, Tonquin, Laos, and Cambodia. The senior author of these fine volumes has made six expeditions to Indo-China since 1923, during which he has explored the whole country and collected a vast quantity of zoological and botanical material chiefly for the Museum in Paris, although the Natural History Museum in London has had a large share.

Monsieur Delacour, and Monsieur Jabouille, who is officially connected with the administration, have always been specially interested in the birds of this region which had previously received little attention, and they have now crowned their work of exploration by the preparation of a complete account of the birds of French Indo-China. The greater portion of the four stout volumes is naturally occupied with systematic descriptions of each species of bird, its distribution and habits; but the introduction contains an excellent historical review, and an account of the geography and climate which may be useful to Fellows of this Society.

The volumes are excellently printed and illustrated with sixty-seven fine

coloured plates, all the work of Mr. Grönvold; we must congratulate the authors for having produced so fine a work on what is, to Englishmen at any rate, a very unfamiliar part of the world. W. L. S.

AFRICA

EIGHTEEN YEARS ON LAKE BANGWEULU. By J. E. Hughes. *London: The Field* [1933]. 10×7 *inches;* xvi+376 *pages; illustrations and sketch-map.* £1 11*s* 6*d*

The author makes no claim to literary skill nor to any special scientific training. And his narrative demonstrates that he possesses neither. The writing of the book has been to him a tougher task than stopping a charging buffalo. But he has other qualities of no small order. He has observed carefully, made copious notes, and has a happy knack of striking on points that are likely to interest almost every sort of reader. The result is a book packed full of information.

Lake Bangweulu is a hunter's paradise. Partly a huge swamp, partly open water, with forest and escarpment at no great distance, it offers favourable refuge for some rare antelopes and a varied assortment of the commoner game. The author takes us all through it in his wanderings. We paddle up and down the open lake and visit the islands; we penetrate the marshes choked with papyrus and ascend into the more bracing atmosphere of the escarpments. Wherever we go we are introduced to the big game, and told many things of interest about the birds and reptiles; even the insects are not neglected. Much is related of the native tribes, their characters, customs, crafts, and superstitions. Nor are we left without thrills and excitements. For there are hunting adventures with dangerous game—elephants, lions, buffaloes, and so on—which are certain to delight the sportsman. Should any hunter intend an expedition to that region he would do well to consult the information on "Safari." For the naturalist there are many facts worth attention. There is, for instance, an explanation of the elephant's rumblings. These are generally thought to be intestinal gurglings, involuntary and without any meaning; but the author maintains—as indeed seems more reasonable—that the animal makes them by breathing through his trunk and uses them as a communication-signal for keeping the members of the herd together. It has recently been asserted that when elephants sleep they lie down on the ground and use an anthill for a pillow. But the author says that they sleep in the standing attitude. Nevertheless they do lie down near anthills; but the habit is not indulged in for resting the head: it is in order that the animal may use the mound to help him in getting again on his legs. But we cannot refer to other points. The book, as Major Maydon in his introduction states, is nearly all marrow: "the dry bones are few, and there is no superfluous meat."

R. W. G. H.

L'EGYPTE ET SES CHEMINS DE FER. By Lionel Wiener. Ouvrage publié sous les auspices de Sa Majesté Fouad I^er^, à l'occasion de la XII^e^ session du Congrès International des Chemins de Fer (Le Caire 1933). *Bruxelles: M. Weissenbruch* 1932. 11×7½ *inches;* 664 *pages; illustrations and maps*

Professor Wiener is an authority on railway engineering, and the list of his published works on railway systems in various parts of Europe, Africa, and South America is impressive. In the present volume he deals exhaustively with those of Egypt and the Anglo-Egyptian Sudan—their history, administration, rolling stock, financial statistics, etc.—and apart from technical data there is much of interest to the general reader.

The author recalls the ambition of that very progressive ruler Mohammed Ali Pasha, after his campaigns in the Sudan, to construct a railway from Cairo to Shendi—the great meeting-place of caravan routes—and thence *via* Kassala to Massowa on the Red Sea, which he realized would effect a saving of some three days on the overland route to India. Actually the initiation of railway construction in Egypt dates from the reign of his grandson, Abbas I. Political exigencies, and the desire for support against the Porte, induced Abbas Pasha in 1851 to decide in favour of England's pressure for railway communication between Alexandria and Suez, in preference to the French project for the Suez Canal. At the time the overland route to India was accomplished in three stages: by horse-drawn barges (later replaced by small tugs) on the Mahmudya canal between Alexandria and El 'Atf, on the Rosetta branch of the Nile; thence by sailing vessels to Cairo; and finally by camel transport to Suez.

The construction of the line, the first railway on the African continent, was commenced in 1852 and pushed with considerable expedition to Kafr Zayat on the Nile, which was reached during 1854. That year however Abbas died and was succeeded by his uncle, Said Pasha, who was influenced by de Lesseps and France in favour of the canal. In consequence railway construction slowed up, but with the financial help of the P. & O. Company the line reached Cairo in 1856 and Suez in 1858.

Although the acceleration of transport between England and India had been the objective of Britain in pressing Egypt to construct the overland route, and in spite of the urgent situation arising from the outbreak of the Indian Mutiny in May 1857, the first additional troops were sent *via* the Cape, apparently to avoid hurting French susceptibilities. When however it transpired that the Turkish and Egyptian Governments had no objection to the passage of troops through Egyptian territory, over 5000 were sent by the overland route during the six months following the end of September 1857, with considerable benefit to the Egyptian exchequer, the rate being £5 for privates and £10 for officers. Railhead at the time was 25 miles from Suez, the remainder of the journey being accomplished by carriage and camel transport. With the opening of the Suez Canal in 1869 the Cairo–Suez portion of the line became derelict, having been replaced by a line from Zagazig *via* Ismailia, completed in 1868. From such beginnings has been developed the efficient and up-to-date present-day service, with sleeping and restaurant cars offering the last word in modern comfort.

Of the many illustrations one might single out as of particular interest the portraits of Mohammed Ali, Robert and George Stephenson, the coloured reproduction of the ornate "locomotive-salon" constructed for Said Pasha, and the photograph of the familiar Upper Egypt express. At the end of the volume is given the full text of the agreement executed on 12 July 1851 between Abbas Pasha and Robert Stephenson for the construction of the first railway in Egypt. In the preliminary negotiations the interpreter was a very minor railway store-keeper called Agha Abdullah, who later received substantial promotion and the title of Bey. Agha Abdullah was in reality a former English officer, who had been converted to Islam. H. J. L. B.

CO-OPERATION FOR AFRICA. By C. F. STRICKLAND. *London: Oxford University Press* 1933. $7\frac{1}{2} \times 5$ *inches;* xiv + 158 *pages.* 5*s*

The title of this book suggests co-operation between the governing powers and the native races for the benefit of Africa. Actually it is an advocacy of the wider establishment of co-operative societies in Africa. The author's definition of such societies is comprehensive; it would even include the Royal Geographical Society and similar bodies established for the mutual improvement of their

members. But though the work contains many references to societies for social or moral reform, the greater part of it deals with co-operative societies for economic purposes such as we know them in England, though of course with modifications to suit the conditions of the other countries in which they have been or will be established. The author's personal experience relates mainly to countries in Asia, where, we are told in the introduction, he was Registrar for Co-operative Societies in three provinces of India for twelve years. The beneficial effect of the movement in India seems not to be questioned either by European investigators, Indian economic writers, or foreign observers. It has inculcated the virtue of thrift and has been potent in raising the level of the agriculturist. It has been a success in Ceylon since the big societies first formed have been broken up into small village units now trained in good methods. In the Dutch East Indies the mistake is said to have been made of subordinating the movement to the local administration and creating village banks managed by officials. Recently however true co-operatives have been formed, managed by the people themselves, but advised, audited, and controlled by competent and reliable co-operative officers in alliance with leaders of native opinion. British Malaya has societies for Malay cultivators and Indian labourers in the country and for all classes in the towns. In Indo-China the State credit system, formerly followed in the Dutch Indies, has been adopted and co-operative societies have languished without expert help. In Japan there are local credit purchase and sale societies and other utilities co-operatively provided. China is less advanced owing to less capable direction.

Generally the author sees in what has been done in Asia and in backward communities in other parts of the world the possibility of wide and beneficial effects of the movement in Africa. So far on that continent, apart from North Africa and Egypt, where the conditions are rather European and Asiatic than African, the co-operative system has been introduced in the Transkei territories of the South African Union, in the Gold Coast Colony and Ashanti, and in Tanganyika —in the last on lines recommended by the author. Preliminary steps have been taken in some other parts. Mr. Strickland considers that the present time, when the tendency of tribalism is to decay, requires some new force by which the natural leaders of the people will either strengthen or in part replace the tribal system, and that this end will be served by the introduction of co-operation; he is satisfied that this will result in no political danger and is consistent with the doctrine of "indirect rule" in native territories. Lord Lugard in his introduction goes so far as to say that "the fundamental principle of the system is identical with that of 'indirect rule'—which were better named 'co-operative rule'—the essential aim of both being to teach personal responsibility and initiative." How effect should be given to this aim is set forth in chapters of the book on the different types of co-operative society; on the principles on which a co-operative law should be framed; and on proper systems of audit, finance, and supervision. All these types, principles, and systems should have relation to the conditions of the people and should tend to create thrift and self-reliance, and so help to form sound public opinion not only in matters of business but in the other more important aspects of life.

The chapters on finance and supervision are followed by three in which are set forth the co-operative ordinance of Tanganyika, drafts of rules, and draft bylaws. These together form a third part of this little book and might well have been printed in small type as an appendix. They will doubtless be of value to an administrator desirous of introducing the system into the territory in his charge, but are of no more interest to the general reader than a translation of them would be, according to the author, to the natives whose organization they are intended

to control. The general reader and native alike will learn more of the purposes and methods of co-operation from the short address by a co-operative organizer to a group of African villagers which constitutes the last chapter of the book. The former is recommended when he has finished its perusal to read again Lord Lugard's introduction which admirably summarizes the work and reinforces the author's view of the suitability of co-operation to the native of Africa. M. N.

L'AFRIQUE: champ d'expansion de l'Europe. By E. L. GUERNIER. *Paris: Armand Colin* 1933. 9 × 5½ *inches;* xiv + 284 *pages; diagrams and maps.* 25 *fr*

This is a strange, nearly fantastic, book. The United States of America have imposed restrictions on immigration; China and India have attempted to boycott European goods; the nations of Europe are suffering from want of markets in which to sell the superfluous commodities resulting from their mass production. The author would meet these difficulties by getting the full value out of Africa in the matter of consumption and production for the benefit alike of Africa and Europe. A sector of the Earth's surface including these continents would provide all natures of foodstuffs and raw materials necessary to supply the people of Europe and a greatly enlarged population of Africa and would consume, with the development of the latter continent, all the material and goods that Europe could supply. It is proposed that this development with these ends in view should be directed by a permanent Eur-african Conference composed of representatives of the tutelary powers—Belgium, England, France, Italy, Portugal, and Spain—and the independent States of Abyssinia, Egypt, Liberia, and the Union of South Africa. The Conference should provide for the moral advancement of Africa—political, sanitary, social, educational, religious, and scientific—and for its material equipment with ports, railways, roads, waterways, airways, telegraphs, irrigation, and electrification. The moral and material developments are to go on simultaneously for some fifty years and are estimated to cost 43 milliards and 100 millions of francs—say £360,000,000 sterling. It is to result in the immigration, mostly of course to the highlands, of 15 or 20 million individuals, or about 500,000 a year, starting from the fifth year, and to "secure to Europe 30 to 50 years of calm, prosperity, and peace."

This brief summary does insufficient justice to the author's extensive study of maps and statistics of Africa which he has put into convenient form for the benefit of the reader, and to the variety of aspects from which he regards his subject so that his work appears as if it were that of several persons or, at any rate, of one person in very different moods. He is both a nationalist and an internationalist, an idealist and a materialist. It is natural that he should go to the French African Empire for guidance as to what should be done for the spiritual enlightenment and material development of Africa, but it savours of prejudice that he should describe England as, both in the Metropolis and in the colonies, everlastingly behaving like a big nation of merchants, often as one of small shopkeepers, constantly pre-occupied with themselves, never with others. He points out that it was for France, essentially the home of the ideal and of progress, to realize the successful formula which claims the reverence of all the powers and may be called the last word of colonial science. The quality of the work and methods of Marshal Lyautey in Tonquin, Madagascar, Algeria, and Morocco, admirable as they are generally admitted to have been, scarcely requires this accentuation by invidious comparison, but M. Guernier has no fondness for England, which he takes at the valuation of M. Siegfried. As a rule however his nationalism is not as crude as above quoted, and he shows an international spirit in the assumption that the six tutelary and four independent nations, each preserving its own sovereignty and liberty of action within its sphere in Africa, would be

prepared to subordinate their national interests to the common ones of the two continents. Many questions however are suggested by a study of his plan for this. Is it likely that Germany would acquiesce in leaving the affairs of Africa to be dealt with by a conference at which she was not represented? Would the non-African members of the British Empire, the existence of which M. Guernier ignores, be content to see trade diverted from them? Is it really intended to suggest that Australia should confine her commerce to the Asiatic sector of the world, as indicated in the map on the penultimate page of the book? What are to be the respective roles in the carriage of produce and of passengers to Europe of shipping, of which so little, and of the axial railway, of which so much, is said by M. Guernier? If the changes in the natures of transport and communications in the next fifty years are in any way comparable with those in the last fifty, how will the scheme stand at the time projected for its completion? We repeat that it is fantastic. It is however put forward with great lucidity, and the book is easy to read in spite of the many figures it contains which are taken for the most part from the publications of the League of Nations. M. N.

NORTH AMERICA

HISTORIC SPOTS IN CALIFORNIA: the southern counties. By HERO EUGENE RENSCH and ETHEL GRACE RENSCH. Sponsored by the California State Conference of the National Society "Daughters of the American Revolution." *Stanford (California): University Press; London: Humphrey Milford* 1932. 8 × 5½ *inches;* xxviii + 268 *pages; sketch-map.* 14*s* 6*d* ($2.50)

Few of the United States can rival California in natural beauty and historical romance, and it is very probable that this environment has prompted its citizens to take those steps to preserve the relics of the past which this book records. Each of the ten chapters is in effect a brief and vivid history of a county, with indications of surviving buildings, and a short bibliography for further study. It should be an invaluable companion to all travellers in California. Those, less fortunate, who cannot visit the sites, will find much entertainment and instruction in these pages. They will be enabled to follow the routes of the Spanish navigators and explorers from New Mexico, the work of the Franciscan missionaries, the trails of the early American pioneers, and the vicissitudes of the gold miners. One unusual element is the number of "ghost towns"—relics of the mining boom, and "paper cities"—one of which was "created" a few weeks before an election, and though uninhabited, returned 521 votes—the names being taken from a San Francisco steamer list! The preservation of buildings has been carried so far that one built as an office as recently as 1905 by the California Development Company in Imperial Valley is being cared for by a body of war veterans.

G. R. C.

PIONEER DAYS IN ARIZONA: from the Spanish Occupation to Statehood. By FRANK C. LOCKWOOD. *New York [and London]: The Macmillan Company* 1932. 9½ × 6 *inches;* xiv + 388 *pages; illustrations.* 20*s*

Professor Lockwood states that his object "is to narrate in an orderly and graphic way the chief incidents that took place in Arizona from the coming of the Spaniards in 1539 to the achievement of Statehood in 1912," and his book can therefore be described as a history of Arizona. It is very difficult to isolate the history of one State from the history of the United States as a whole. The artificial boundaries of an American State or of an English county are a handicap to the historian of either. Professor Lockwood has surmounted this difficulty and written a lively and readable story of this south-western State in which

"Spanish cultural and material civilization still exerts a sort of magic sway." He describes in detail the history of the Spanish exploration and occupation, the American hunters and trappers, the operations of the American army in 1846, and the scientific expeditions of the fifties. The value of these chapters would have been enhanced if they had been illustrated by more adequate maps of the routes of the explorers. Arizona was created a Territory of the United States in 1863 and finally became a State in 1912. In writing the history of the period between these two events the author has obtained his information at first hand, by interviewing many of the persons whose actions he here describes. For the geographer, the most interesting chapters are contained in the latter part of the book, in which the history of early agriculture, of mining, of the roads and trails, and of the foundation and developments of towns are discussed. In the opinion of the author, the mines of Arizona "have made her fame and her fortune." In 1912 the State received a very progressive constitution, which included the referendum and the recall, and was described by an enthusiastic delegate as "the greatest and grandest document since the Declaration of Independence." The book contains a number of useful illustrations and an index, but lacks a formal bibliography. It seems a pity that the author did not include a chapter on the geography of Arizona, which would have made the whole book easier to follow. E. W. G.

AMERICAN POPULATION BEFORE THE FEDERAL CENSUS OF 1790. By EVARTS B. GREENE and VIRGINIA D. HARRINGTON. *New York: Columbia University Press [London: H. Milford]* 1932. 9×6 *inches;* xxii+228 *pages.* $3.50 (23*s* 6*d*)

In the preface it is stated that the earlier compilations of Dexter (1887) and Rossiter (1909) have proved their usefulness to scholars, but that since the issue of these publications much additional material has become available. The plan of the book is to assemble in a single volume all the known data, whether printed or in manuscript collections, such as those of the Public Record Office in London or the Library of Congress. That this was no light task is clear from the fact that the bibliography contains some 300 entries.

For the statistician there is an interesting note on Method of Calculation, in which it is stated that "most of the estimates of population during the colonial period were computed on the basis of the number of militia, polls, taxables and tax lists, and families and houses." It appears that the militia can be estimated at one-fifth of the total population; the polls (all men above twenty-one) at one-quarter; the families were reckoned at 5·7 to 6; and the houses were considered to hold at least seven.

As would be expected, the earlier estimates are not very accordant. We begin with Chalmers's estimate of 1980 colonists in America in the year 1625. The next entry is an estimate of 50,000 English inhabitants in 1641; and the next 200,000 English in 1663. In 1671 we find an estimate of 50,400 "total forces by land" which would presumably imply a population of about 250,000 (southern colonies not included); and so on. It is curious to note the various estimates of the population of the Thirteen Colonies about the time of the War of Independence (1775–81). Here are some of them: 1765, 2,240,000 inhabitants and 560,000 white and black able to bear arms; 1766, 250,000 fighting men at least; 1774, 2,141,307; 1775, 2,418,000; 1783, 2,389,300. These guesses were all much under the mark, for the first census, of 1790, gave the total of 3,929,000—practically 4,000,000. The number of available fighting men during the war must thus have been many hundreds of thousands.

The greater part of the book is taken up with detailed estimates of the popula-

tion of the individual colonies and states, both general, for the whole of each state, and local, for counties and towns. These estimates range from the early part of the seventeenth century to 1790. All this is the raw material of history, and will be indispensable to serious students of the growth of the American colonies. There is an interesting section on the numbers of the "Western Indians," that is, those "living outside the jurisdiction of the seaboard provinces and states." C. F. C.

THE CHANGING CULTURE OF AN INDIAN TRIBE. By MARGARET MEAD. (Columbia University Contributions to Anthropology. Edited by FRANZ BOAS. No. XV.) *New York: Columbia University Press* [*London: Humphrey Milford*] 1932. 9½×6 *inches;* xiv+314 *pages.* $4.50 (28*s net*)

This sad record presents with admirable restraint the story of the degradation under white influence of an Indian tribe, which only seventy-five years ago was still leading a reasonably free and happy tribal life. To spare the feelings of its members, the group selected is presented under the pseudonym of the Antler tribe. Its reservation is in the Mississippi Valley, on land that is partly old Antler territory; here they maintained their permanent villages, planted their maize, and occasionally—for the Antlers were generally a peaceful people—followed the warpath. Primarily the volume is a study of tribal women under the stress of modern cultural contacts, for although the tribe is in a bad way socially and morally, and contains many half and mixed breeds, it survives as a unit, owing in part to the persistence of tradition among the older folk, in part to the existence of the reservation guaranteed it by the Government.

No adequate summary is possible in a short review—the book must be read for the position to be realized, but it is not impossible to indicate the main factors that have brought about the existing condition.

On the political side, although there is talk about the Great White Father at Washington, the Antler conceives the employees of the Indian Bureau as responsible for his wrongs and suffering; he also realizes (or at least believes) that the employees of the Bureau enrich themselves at his expense. He talks of these men as arriving with a gripsack and going away with a car. There is nothing in his attitude that in the least resembles the respect that a Melanesian community or African tribe commonly shows for its white administrator. "From a member of a self-governing, politically self-conscious unit, he has been degraded to a member of a miscellaneous group of people who have hereditary claims to receive special treatment and to give nothing in return." On the social side, in the place of a coherent social fabric with traditional beliefs, customs, and manners, there now exists a series of almost isolated household units, whose younger members are subjected to all the most obvious influences leading to unhappiness and delinquency that we meet with among ourselves—broken homes, alcoholism, profligacy, and venereal disease. C. G. S.

POLAR REGIONS

AN ARCTIC SAFARI: with camera and rifle in the land of the Midnight Sun. By RICHARD L. SUTTON. *London: Henry Kimpton* 1933. 9½×6 *inches;* 200 *pages; illustrations and sketch-map.* 12*s* 6*d*

Richard L. Sutton, Professor of Dermatology at the University of Kansas, who had already travelled in Africa, Indo-China, and Asia generally, decided that for the summer of 1932 he would take his family to the Arctic. Following his usual custom he went to a travel bureau and had arrangements made for an expedition to Spitsbergen and beyond.

In the introduction the author expresses his gratitude for the advice of Dr. Stefansson, but it is difficult to imagine Vilhjalmur Stefansson setting out on a short summer trip with six rifles and a wheelbarrow full of high-powered cartridges. It was when declaring his stores to the Customs Officials at Bergen that the author was approached by a deputation of journalists whom he had no difficulty in satisfying by his generosity in photographs. It was here, too, that his son Dick "came breezing in on the *Venus* from Newcastle," with an elephant gun in one hand and in the other an ornate African knobstick discovered in Glasgow, "that moist little burg." After this promising start the book is a little disappointing: it is not true to its type. The expedition was undertaken "for educational purposes as well as for sport," and consequently it varies between the light-hearted description of first impressions told in a style made popular by the sub-titles of silent cinema films and an advertisement, chiefly in the form of excellent photographs, of a ruthless slaughter of the great arctic mammals justified by the unconvincing excuse of specimen collecting. The book is expensively produced, but no description of its appearance would be complete without a mention of its dust cover, where one sees a party of philosophical walruses expressing their mild disapproval at the appearance of an athletic young man, dressed somewhat in the style of a Cossack dancer and who certainly never came from the neighbourhood of Spitsbergen. One presumes that with his poised harpoon he is symbolic of the North. J. M. S.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

WISSENSCHAFTLICHE ERGEBNISSE DER DEUTSCHEN ATLANtischen Expedition auf dem Forschungs- und Vermessungsschiff *Meteor*, 1925–1927. Edited by ALBERT DEFANT. Band IV. Erster Teil. Ozeanographische Methoden und Instrumente. By GEORG WÜST, GÜNTHER BÖHNECKE, and HANS H. F. MEYER. *Berlin: Walter de Gruyter & Co.* 1932. $11\frac{1}{2} \times 8\frac{1}{2}$ *inches;* xii + 298 *pages; illustrations and maps. Subscription price M.*47 (*unbound M.*43)

During recent years the tendency has been to strive after ever-increasing accuracy in the determination of temperature and salinity in the sea, of the order of 0·01° C. and 0·01 S. per thousand, or even better. Such an accuracy is illusory unless the depth of observation is known with corresponding exactitude. More than a third of this volume is devoted to the subject of determinations of depth by means of a pressure gauge consisting of two reversing thermometers, one of which is protected against the pressure of the sea while the other is unprotected. This method was first used by Ruppin in 1906. Tests made at Charlottenburg before the cruise on the *Meteor's* forty-one unprotected thermometers showed that an excess pressure of one kilogram per square centimetre, roughly one atmosphere or a head of 10 metres of water, caused on the average an apparent rise of temperature of 0·09° C. owing to the compression of the bulb. This coefficient was found to fall slightly with age, but it is remarkable that it appeared to be nearly independent of temperature and initial pressure. The results were very consistent, and Dr. Wüst is of opinion that the mean probable error from all causes is 0·0006° C. Apart from gross errors it is improbable that the greatest error in a determination of depth at 1000 metres will be more than 1 per cent., and as a rule the error will be less than half this.

In deep water the observations of temperature and salinity were made in three series; from six to ten waterbottles with thermometers were used on the wire at once and unprotected thermometers were fixed at the top, middle, and bottom

of each series. The readings showed that very large errors of depth can arise if the line is not vertical; even with angles of deviation of less than 5° an error of 30 metres is to be expected at 5000 metres, and an error of 440 metres at an angle of less than 25°. Such errors were unexpected because the scanty previous experiments in this direction were made with only a few bottles on the wire. There is no doubt that in the future at least three unprotected thermometers will have to be used in each series if the work pretends to any accuracy.

Some of the temperature observations in the depth were repeated and differences were found which in the past would have been put down to real changes in time; the unprotected thermometers showed that they were due to differences of depth. In the same way, large errors might arise in the temperature ascribed to a given depth if the latter were not corrected; an extreme case was an error of 1·46° C. at 600 metres.

Unprotected thermometers were also used to check the soundings made with the wire of the Lucas machine; they were carried in a frame with a propeller release fixed about 50 metres above the bottom tube. There were thirty-one satisfactory soundings made at the same time by wire, thermometer, and echo. The subject is discussed fully in another volume, but for the present it may be said that the mean error of a thermometer sounding may be estimated at 25 metres.

The relation between echo and wire soundings is also discussed in detail. The mean ratio of echo to wire depths was found to be 0·993 for wire angles of less than 5°, 0·982 for angles of 15° to 19°, and 0·966 for angles of 30° to 34°. The factor deduced for reducing wire soundings to an angle of 0° was $k = v - 0{\cdot}005$, where v is the mean smoothed value of the ratio for the depth in question. All the soundings printed have been so reduced to obtain the "corrected wire depth D_k." Even this correction is not enough to eliminate all the differences between the three methods since the wire is not always straight even with an angle of 0° at the surface. At the same time an echo depth must often be too small on account of the slope of the bottom.

Dr. Maurer corrected the echo soundings for the local temperature and salinity (unfortunately it is not said what tables he used) and came to the conclusion that the mean corrected wire depth is 0·4 per cent. too high and the echo depth 0·3 per cent. too low. The "true wire depth" is then "corrected wire depth multiplied by 0·996," the "true echo depth" the "corrected echo depth multiplied by 1·003," and the "true thermometric depth" the thermometric depth increased by 15 metres. Finally, the "true depth" given in the tables, the *wahre Tiefe*, is the mean of as many of these depths as may be available at a position. A table of the mean errors of wire soundings for various angles of stray is given which should be valuable to surveyors, and the whole section dealing with measurements of depth is one of great importance to oceanographers.

Surface temperatures read with a bucket in the bows were on the average 0·1° C. higher than those determined with a resistance thermometer in the main condenser intake, but differences of over 2 degrees were met with. The improved reversing thermometers were believed to be accurate to 0·005° C. under the best conditions. Attention is drawn to the little-known fact that reversing thermometers wear out. Salinity was determined by titration of the chlorine in duplicate by independent observers, and many samples were also checked on shore after the end of the cruise. It is believed that in 75 per cent. of the samples an accuracy of 0·01 S. per thousand was attained.

The laboratory, the winches and wire, the waterbottles, and the current meters are described in equal detail in conformity with the wish of Professor Merz, that all experience gained should be readily available to future expeditions, for he himself had had to spend both time and money to fill in the blanks in the

descriptions of the equipment of earlier expeditions. No such charge can be brought against the present volume, which is one on which the authors are to be congratulated. D. J. M.

OCEANOGRAPHY. Bulletin of the National Research Council, June 1932. Number 85. Physics of the Earth. V. Prepared under the auspices of the Subsidiary Committee on Oceanography, Division of Physical Sciences, National Research Council. *Washington, D.C.: National Academy of Sciences* 1932. 10 × 6½ *inches; 582 pages; illustrations and maps.* $5.00

This book is one of a series on the various branches of geophysics written for scientists who are specialists in some other branch. Each department of oceanography is treated by a specialist—there are no less than sixteen—so that there is a certain amount of unavoidable overlapping and repetition. Further, it has not been possible to give more than a sketch of the subject in some cases.

In the introductory chapter Commander N. H. Heck emphasizes the view that oceanography as a branch of geophysics is concerned with life in the ocean only in relation to its physical environment. In the chapter on the properties of sea-water the mean compressibility is given as 0·0000046; the unit of pressure is not stated, but if it is the bar, as in Ekman's original paper, this figure should be multiplied by ten. It is to be noted that in the section on the velocity of sound in sea-water no mention is made of the British Admiralty Tables, which are used all over the world. The various reversing waterbottles are well illustrated, but there is no drawing of any type of insulating bottle, and the description reads as if it were necessary to insert the thermometer afresh for each observation.

Professor T. G. Thompson's accurate work on the major constituents of sea-water is well known, and it is therefore the more to be regretted that he supports the use of "chlorinity" instead of "salinity" in describing a sea-water. It is true that a certain convention attaches to the meaning of "salinity," but there is a convention attached to "chlorinity" also. It is doubtful whether many oceanographers would have a clear idea of a water of which the "chlorinity" was given unless they had the tables at hand; but salinity (so many parts of sea salt per thousand by weight) is clear to every one. There is a slip in the definition of salinity; the clause about ignition at 480° C. should be deleted. Carbon dioxide and related subjects are treated at some lengths. G. McEwen writes on the theorems of V. Bjerknes and V. W. Ekman, while A. Schumacher describes the general circulation of the oceans. The sea ice is treated by Commander E. H. Smith, of the Ice Patrol. Additional chapters on oceanographic instruments are contributed by F. M. Soule, W. E. Parker, and C. O. Iselin. The three final chapters deal with the relation of oceanography to meteorology and biology, and with paleography.

Though this book is necessarily not detailed enough for the specialist, it should be valuable to workers in other branches of science, and it contains a good bibliography. D. J. M.

THE ATLANTIC RIFT AND ITS MEANING. By HOWARD B. BAKER. [*N.P.*]: *Copyright by Howard B. Baker, Burton P. Baker, Caroline G. Baker* 1932. 11 × 8½ *inches; 306 pages; diagrams and maps*

This is an extensive treatise on continental drift in which the author considers that, until Quaternary times, a planet now represented by the asteroids remained whole; and that the gravitational attraction of this planet, for which the name "Penthus" is suggested, was sufficient to cause marked eccentricity in the Earth's orbit, resulting in periodical gravitational encounters between the Earth and Venus. Tidal stresses occasioned by these encounters are held to be responsible

for the major orogenic movements throughout geological history, of which by far the most important is supposed to have occurred in late Miocene time, and resulted in the stripping off of a considerable portion of the Earth's crust—thus forming the moon. This cataclysm is believed to have taken place over a period of some nine hours, during which the (present) Pacific face of the Earth was in alignment with both Venus and the sun. The author supposes that the removal of *sial* by this mechanism resulted in fusion of the underlying *sima* which flowed towards the depression thus created, and carried with it the shattered remnants of the original crust in the shape of the present continents.

All this, in the absence of any attempt at mathematical discussion, is mere fantasy. G. W.

GRUNDZÜGE DER PHYSIKALISCHEN VERHÄLTNISSE DER festen Erde. By ERNST TAMS. (Geologie der Erde. Edited by ERICH KRENKEL.) *Berlin: Borntraeger* 1932. $10\frac{1}{2} \times 7$ *inches;* viii + 184 *pages; diagrams and maps. M.*14

This book gives, in comparatively small space, a very useful summary of our knowledge of the structure of the Earth. It is written primarily from a geophysical standpoint, and the geographer will find it hard to assimilate unless he has a sound basis of knowledge in such subjects as Seismology, Earth Temperature, methods of measuring gravity, Isostasy, and related matters.

The first chapter deals mainly with general facts, discussing the size and shape of the Earth and the horizontal and vertical disposition of the main elements in the Earth's structure. The next two chapters deal somewhat fully with the constitution of the Earth—its density and chemical composition. The light thrown upon the structure by the various types of earthquake waves receives attention, and here, as elsewhere, the author appears to have been at pains to assess the evidence fairly. Unlike some foreign, and English, books, the bibliographies at the end of each chapter give evidence that authorities outside the author's own country have been followed with care, and their work correlated.

The last two chapters deal mainly with the thermal conditions of the Earth, and the question of gravity. The age of the Earth is also discussed, and an interesting section is added concerning the chronology of the Ice Age. The variations in the chemical composition of the rocks of the land masses and ocean beds is stressed to some extent, and throughout the book the author has given some useful tables, *e.g.* those dealing with the distribution of the elements in the formation of the crust, and those concerned with the radio-active materials.

The volume is rather outside the scope of the geographer, and perhaps even of the geologist. But the geophysicist has much to tell geographers that is vital to their study, and Dr. Tams has arranged his material well and in a handy form.

THE BOOK OF THE TIGER: with a chapter on the lion in India. By Brigadier-General R. G. BURTON. *London: Hutchinson & Co.* 1933. $9 \times 5\frac{1}{2}$ *inches;* 288 *pages; illustrations.* 12*s* 6*d*

In this book we have a full account of the tiger. His natural history is considered in detail, such matters as breeding, gestation, characters, and habits receiving much attention. Certain controversial points are carefully discussed. Why, for instance, are white tigers not uncommon and black ones very rare, when white leopards are rare and black ones very common? What is the length of the largest tiger? Has a 12-feet long animal ever existed? Do tigers hunt by sight, scent, or hearing, or by a combination of all these faculties? How does the beast kill his victim? Does he seize it by the back and dislocate the spine or adopt some more rough-and-tumble procedure? In all such matters there is conflict of

opinion; but the author has sifted the evidence carefully, added the results of his own observations, and is thus able to give an authoritative decision. Apart from natural history, there are many hunting episodes. The different methods of tiger-hunting are discussed and some remarkable native devices described. This part will specially appeal to the sportsman, as will the interesting chapter on man-eaters. More practical is the author's advice on camps, rifles, and equipment, and the list of books and journals that deal with tiger hunting. There is also a chapter on the Indian lion, now occupying a very subordinate place to the tiger and confined to the Gir forest in Kathiawar. General Burton is a high authority and his book is thorough and complete. R. W. G. H.

GÉOGRAPHIE DES PLANTES. By HENRI GAUSSEN. GÉOGRAPHIE DES ANIMAUX. By MARCEL PRENANT. (Collection ARMAND COLIN. Nos. 152, 153. Section de Géographie.) *Paris: Armand Colin* 1933. 7×4½ *inches; 222, 200 pages; maps.* 10.50 *fr. each*

There have been a number of recent publications in French and German on plant and animal geography, forming either part of general treatises or independent books. The two named above belong to the latter category, while Vol. III of the revised edition of de Martonne's 'Traité de Géographie Physique,' to which both authors acknowledge indebtedness, is an example of the former. In both cases two fundamental problems are involved. The first is the question as to what aspects of the distribution of plants and animals over the Earth's surface are of real significance to the geographer. Here there is as yet no established tradition, and thus ample scope for individual treatment. Whatever answer is given however a further problem remains, far more serious in the case of zoogeography than with phytogeography. Can the essentials be put in each case without assuming a knowledge of taxonomy beyond the reach of the average geographer?

In the present case we find that M. Gaussen, though he does not attempt to discuss the meaning of his own statement, states definitely that he approaches his subject from the standpoint of geography and not of botany. He makes also a sustained and successful effort to cater for readers with a limited knowledge of systematic botany. Thus his text includes a clear and simple classification of plants. A fuller scheme is relegated to an appendix, and an index of plants mentioned is added, both French and Latin names being given, with cross-references to the detailed classification scheme. The contents also include an interesting if summary survey of the plant-cover of France, which at once illustrates the general principles laid down elsewhere and is in itself of much value to the geographer, man's influence on the natural conditions being well brought out. If in places, owing to the mass of material included and the limited illustration possible, the book, in the author's own phrase, is somewhat "arid," it may yet be warmly recommended as a satisfactory introduction to a vast subject. Particularly noteworthy is the way in which the author contrives not only to set forth known facts, but by his critical comments opens out wide vistas for the future investigator.

As already suggested, M. Prenant has a far more difficult task, but to the reviewer he appears rather to evade than to face the special problems presented. The word "geography" in his title seems to be purely a matter of convention, for, as his opening paragraphs show, he makes no attempt to take account of any recent definitions of the scope of the subject, or to consider what the geographer strives to do. He offers no classification of animals, and though his pages teem with specific and generic names, often of forms belonging to obscure families, little guidance is offered as to systematic position, and there is not even a brief

index of animals mentioned. In some cases vertebrates and invertebrates of many kinds are jumbled together in lists in so heterogeneous a fashion as to raise a perhaps unworthy doubt as to whether the author himself visualizes clearly the animals named. To this multiplication of Latin names is added an extensive and forbidding technical terminology, far beyond what is required in so small a book. Further, the author trespasses constantly on M. Gaussen's territory, mentioning, for instance, such apparently "alien" subjects as Raunkiaer's life-forms and Willis's Age and Area hypothesis, and discussing in some detail the distribution of the great plant formations. Both authors also discuss the history of the land-masses throughout geological time, with some minor differences in detail. Apart from this unfortunate over-lapping it is not wholly clear what kind of reader M. Prenant has in view, for generalizations of a somewhat elementary character are mingled with short accounts, with very insufficient documentation, of highly technical topics. Many of the details given are of interest, but on the whole the book can scarcely be recommended to the geographer. It does little to solve the problem of what zoogeography, as a branch of the larger subject, should include, or how it should be treated. M. I. N.

A TEXTBOOK OF GEOLOGY. Part I. Physical Geology. By CHESTER R. LONGWELL, ADOLF KNOPF and RICHARD F. FLINT. *New York: John Wiley & Sons; London: Chapman & Hall* 1932. 9×6 *inches;* viii+514 *pages; illustrations and maps.* 23*s*

The three professors of Yale who write this book were responsible for the last edition of Part I of the standard 'Textbook of Geology' of Pirsson and Schuchert, which many students in this country found of great value. They have considered it preferable to write a new book rather than to be fettered by loyalty to the late Professor Pirsson of the kind necessary to preserve the manner of presentation of material he used years ago. This is an example to be widely followed. Part II of the present work will be the old volume on Historical Geology revised by Schuchert.

There is not a great deal of essential change in this successor of Pirsson and Schuchert, except that the two parts are issued separately. The essential processes involved in weathering and erosion by various agencies are systematically presented in somewhat different order, but in the same clear and well-illustrated style as that set by W. M. Davis and followed in most American works. It is strange however that a certain *naïveté* in their descriptions of the development of mountain topography does not appear to have struck geologists. In a recent discussion it was pointed out that if certain moderately large recumbent folds in a British area developed just as the text-books say, their crests would gradually heave themselves up to a height of at least 12 miles, allowing both for some compensation and for all the erosion which has taken place upon them. Moreover the flexed forms at present exposed in mountains indicate a great degree of plasticity and could not have been developed near the surface. Whatever primitive drainage set to work to model the original tectonic topography must have worked on structure very different from that which the modern river systems are retouching, and all drainage in highly folded mountain structure must be a kind of superimposed drainage. It seems to be a pity to fail to recognize, as the present and most other standard texts do, that progressive deepening of erosion will in such cases involve progressive adjustment to deeper structure.

The later chapters of the book deal with tectonic matters. They are followed by appendices on Minerals, Rocks, Topographic Maps, and the Time-Scale of Earth History. The last is a very useful brief tabular summary, but the third seems too slight to be of much value. The index is full and accurate. A. S.

RASSENKUNDE UND RASSENGESCHICHTE DER MENSCHHEIT. By EGON FREIHERR VON EICKSTEDT. *Stuttgart: Ferdinand Enke* 1933. $10\frac{1}{2} \times 7$ *inches;* 288 *pages* (Erste u. Zweite Lieferungen)*; illustrations and maps. M.*10

It is difficult to do justice to a work with only a third of it before one, but there is little doubt that all who are interested in the physical development and distribution of Man will find this book of great importance. The general scope appears to be a special consideration of the present races of mankind, their distribution and superficial features, and the geographical conditions which have made for their present distribution. Cultural relations are discussed briefly and craniology more briefly still. Numerous cross-headings are provided in leaded type and the whole work is extraordinarily easy to find one's way about in. References, in the form of footnotes, are numerous and almost every page is illustrated with a beautiful series of well-chosen pictures, some original, others collected from various sources. There are numerous maps.

The enormous scope of such an inquiry is manifest, and in reading through some of the paragraphs the reader at first sight is inclined to think that insufficient space may be allotted to the subjects discussed in them, but if the work is judged as a whole, as far as can be seen from two parts, a very careful balance has been preserved. Naturally there is much that will not be of direct interest to geographers, but so far few if any have attempted to collect together the vast accumulation of material which exists on the subject of the relation of man's physical form, as measured by his superficial features, to the past and present geographical surroundings in which he lives, and the method of arrangement should help the student, even if his linguistic ability is not great, to find his way about. The author in his general classification has abandoned that basis most generally accepted to-day, namely hair form, and prefers skin colour, dividing the White stem into Europide, Polyneside, Weddide, and Ainuide; the Black into Negride, Melaneside, Pygmide, and Australide; and the "Mongoliform" into Mongolide, Indianide, Eskimide, and Khoisanide, the latter including the Bushmen and their allies. Like any other classification this has its disadvantages, and it will be interesting to see whether in the revised form now presented this scheme will once more find the acceptance which it did formerly. L. H. D. B.

MEMORIE SCIENTIFICHE, 1883–1932. By LUIGI DE MARCHI. Raccolte da colleghi, allievi ed ammiratori in occasione del suo 75° compleanno. *Padova: Cedam* 1932. $11\frac{1}{2} \times 7\frac{1}{2}$ *inches;* lxxii+854 *pages; portrait, diagrams and maps*

On the seventy-fifth anniversary of the birth of Professor Luigi De Marchi, who has for many years taught Physical Geography in the University of Padova, his colleagues, pupils, and admirers have wished to prove their esteem and their affection by collecting and republishing in a large volume some of the master's scientific memoirs. The book also contains a biography of De Marchi, contributed by Professor Giotto Dainelli, and a complete list of his writings. The memoirs, forty-five of which are reprints, deal mostly with Physical Geography and are grouped in six parts: Meteorology, Climatology and Glaciology, Oceanography, Continental Hydrography and Morphology, Physics of the Earth, and Miscellaneous. Moreover some unpublished notes, written by De Marchi in 1932, have been added.

The first half of the volume contains some of the memoirs belonging to De Marchi's first works in the geographical field; among the larger papers special mention should be made of the "Researches on the Mathematical Theory of the Winds," the study "On the Mathematical Theory of Atmospheric Circulation," an "Essay on the Application of Hydraulic Principles to the Theory of Air

Currents," the "Theory of the Double Daily Oscillation of the Barometer," the studies on thunderstorms, on cyclones, on the thermal gradient, and on vertical acceleration in the atmosphere. All these essays combine accuracy with breadth of judgment, and have often given rise to interesting discussion in foreign meteorological journals.

Among the memoirs on Climatology and Glaciology are to be noted the studies on "The Periodical Variations of Glaciers," phenomena studied mathematically by De Marchi; but, above all, attention is called to the large memoir, first published in 1895, on "The Origin of the Glacial Period," which fills nearly a hundred pages. The author, after having set forth the climatic conditions which influence the variations of actual glaciers, develops, in an original way, the theory of the air's temperature and its variations; then, having resumed and criticized all previous theories of the origin of the Glacial Period, he concludes in favour of a meteorological explanation: namely a variation in the transparency of the air as regards both solar and terrestrial radiation.

The writings on Oceanography refer partly to general arguments and are partly dedicated to the study of the Adriatic Sea. Notable among the first are the "Theory of Deep Sea Soundings," "Vertical Distribution of Salinity and Temperature and the Convex Movements of Sea Waters," and "Lagoon Morphology and Stationary Regime of the Tide." The studies on the Adriatic often contain results of general importance; they deal with the Physics and Chemistry of Sea Water, and particularly with the superficial currents in relation to Salinity and Temperature, Internal Waves and Tide Progression, and the Variation of Level in Correspondence with Glacial Quaternary Expansions. The recent study on "Shore Variations in Correspondence with Climatic Variations" refers to a coast tract of the Adriatic, between the mouths of the Piave and Livenza.

In the fourth part of the volume there are studies on Karst Hydrography. "On Karst Hydrography in the Tableland of Sette Comuni," and "The Waters of the Karst"; an essay on "The Springs in Alluvial Ground"; and the memoir "The Hydrography of Colli Euganei." This last is a real study of Geomorphology, and in spite of being now about thirty years old, is still an excellent model; basing his views especially on the study of valley profiles, De Marchi reconstructs the morphological and hydrographical evolution of the region and finds testimony of unequal upheavals of the ground in quite recent times. More theoretical, but always original, are the writings on "Geometrical Elements of the Ground deduced from the Topographical Map," and the "Attempts at a Theory of the Equilibrium Shapes of the Ground." Minor writings deal with the temperature of Lake Como and with the Termal Waters of Montegrotto (Euganei).

Among the more properly geophysical studies, grouped in the fifth part, are two memoirs on the theory of Terrestrial Isostasy. Two more papers may be linked with these: "Elastic Theory of Tectonic Dislocations and its Geological Applications," and "Theory of Waves propagated on the Flat Surface of an Elastic Body and its Application to Seismogram Analysis." Though the method in these studies is a mathematical one, the conclusions and applications are no less interesting to the Geographer. Let us remember also that lucid article, "What is the Earth?" which, though published in 1907, still remains a clear summary of our knowledge of the internal condition of our Globe.

The last section of the volume comprises four papers on various subjects, among them Fridtjof Nansen's biography, and a paper on the relations between Geography and Politics. We may say however that only that part of De Marchi's work which belongs to the field of Physical Geography (doubtless the most important one and his favourite field) is represented in this volume, which

naturally does not include all his publications. But we can gather from it how varied were his activities, which extended also to political and economical Geography, and even, in the beginning of his career, to the fields of Philology and Literature. G. D.

ECONOMIC AND HISTORICAL GEOGRAPHY

NORTHMEN OF ADVENTURE: a survey of the exploits of dominant Northmen from the earliest times to the Norman Conquest. By CHARLES MARSHALL SMITH. *London: Longmans, Green & Co.* 1932. 9×5½ *inches;* viii+390 *pages; illustrations and sketch-maps.* 16*s*

Interest in the history of the Vikings has recently quickened, partly, no doubt, from the revival of theories of Nordic superiority. Kendrick's 'History of the Vikings' is the most authoritative and comprehensive of recent works, with which Mr. Smith does not attempt to compete. His book is intended for the general reader: he has accordingly drawn largely upon the Sagas for his story of the Northmen down to the Norman Conquest. He appears to be well acquainted with the literature of the period, and to give a fair summary of facts and opinions. The narrative ranges from Novgorod and Constantinople to Greenland and Labrador, and many striking characters, from the mythical Odin to Harald Hardrada, appear in it.

Mr. Smith is so anxious to assert the superiority of the Northmen that he overworks the epithet "dominant." Whatever the cause, the Vikings were in the main raiders, self reliant and courageous no doubt; it was only when fused with other peoples that they reached a high cultural standard. The author has concentrated upon Viking deeds of arms rather than upon the economic influences of their constant voyaging. G. R. C.

SELECT TREATIES AND DOCUMENTS, to illustrate the development of the modern European states system, 1815–1916. Edited by R. B. MOWAT. Enlarged Edition. *Oxford: Clarendon Press* 1932. (First published 1916.) 7½×5 *inches;* lxiv+148 *pages.* 2*s* 6*d*

It is a pity that this compact little handbook is a reprint and not a new edition. So far as they go the documents are well selected, while the introduction gives a clear and concise summary of the situations to which they refer. Among the subjects dealt with are formation of the Triple Entente and the Triple Alliance, the undertakings guaranteeing the neutrality of Belgium, Luxemburg, and Switzerland, the position of Poland, Schleswig-Holstein, and Egypt, and the settlements reached at the conclusion of the Franco-Prussian War, the Boer War, the Italo-Turkish War, and the Balkan wars. As the book was compiled in 1916 it cannot treat the Great War adequately: its utility really ceases with 1914.

J. DE V. L.

ANTHROPOGEOGRAPHIE (Sammlung Göschen. Band 1054). GEOGRAPHIE DER KULTURLANDSCHAFT (Sammlung Göschen. Band 1055). By OTTO MAULL. *Berlin: Walter de Gruyter & Co.* 1932. 6½×4 *inches;* 136, 142 *pages; maps. M.*1.62 *each*

In the first of these small outlines, Dr. Maull treats of the degree to which man is both a product, and an agent in the fashioning, of the "Landschaft." After protesting that no question of determinism arises, he proceeds to state certain "laws" of anthropogeography, and to set up a rigid system. The greater part of the essay however is a statistical survey of the present distribution of population, races, cultures, and political systems. There is little discussion of such matters

as migrations and acclimatization, and none, apparently, of depopulation. He regards races as varieties of climatic adaptation.

The second essay discusses the "cultural landscape" as the work of man. The earlier sections deal with economic geography, settlement, and trade; in the later, various cultural types are distinguished. It is therefore the complement of the first. G. R. C.

THE MERCHANT VENTURERS OF LONDON: a record of Far Eastern trade and piracy during the seventeenth century. By CHARLES GREY. *London: H. F. and G. Witherby* 1932. 9 × 5½ *inches; 288 pages; illustrations.* 12*s* 6*d*

It is curious to note how the seventeenth century, once thought so dull and colourless beside the splendid sixteenth, is now coming into its own. It would seem that just as three generations must elapse before an old-fashioned object becomes an antique, so three centuries must elapse before a period, in English eyes at least, is invested with glamour. Mr. Grey here retells the story of the first half-century of English trade, legitimate and illegitimate, in the Far East, and although such men as Will Adams, William Hawkins of the *Hector*, William Methwold, Captains Shilling and Weddell, are scarcely the obscure and forgotten figures he would have us believe, their adventures, cleverly strung together as they are by the author from original narratives and letters, are eminently worth re-reading. As regards his sources, Mr. Grey is again somewhat misleading, for it is not really true that they lie buried in volumes "which usually lie undisturbed on the remoter shelves of ancient libraries, their brittle and yellow pages slowly falling to decay." Much of the text is between quotation marks, but authorities are rarely cited, and it is only by inference that it can be decided that the 'Letters Received,' the 'Court Minutes,' and other source material which we owe to the critical scholarship of Sir William Foster, in addition to 'Purchas his Pilgrimes,' must have been utilized. No great care has been exercised to insure accuracy of detail. Of William Hawkins, for example, who is identified positively as John Hawkins's nephew, Mr. Grey writes that he commenced his career in 1582, sailing with Fenton for the discovery of the North-West Passage, that the venture ended in shipwreck, and that subsequently Hawkins sailed through Magellan's Strait. Now William Hawkins the younger commenced his career with Drake in 1577, his voyage with Fenton was for the South Seas, and did not end in shipwreck, while there is no record that he later passed Magellan's Strait. Again, a very little inquiry would have given the author information of Methwold's family and antecedents prior to 1615, of which he declares that nothing is known, and it is misleading to say that this famous servant of the East India Company died at his house "in the Cromwell Road."

Enough has been said to show that this is not a book for the scholar, but Mr. Grey, as witness his loving description of his copy of Harris's 'Travels,' writes with an amateur's infectious enthusiasm, and he will capture the fancy of the general reader, who does not greatly care where exactly the record stops, and a lively power of reconstructing the past steps in. Two opening chapters sketch the Merchants, the Ships, and the Mariners of the period, and then follows the ever-popular story of Will Adams's romantic life in Japan. Each chapter is a separate unit, and after Will Adams comes the grim account of the Amboyna Massacre, which the author first read in a little eighteenth-century transcript which he came across at Lahore. This story again is in happy juxtaposition to the livelier tale of how William Hawkins, rather to his own astonishment, found himself married to a motherless Christian maiden from Jehangir's Court, and how he left her a consolable widow on the voyage home. The Sea Fight of Ormuz, and the piratical adventures of the *Roebuck* throw into relief some of the

more prosaic trading voyages, while the records of the licentious life of Francis Day, "Founder of Madras," make, at this distance, amusing reading. It is to be presumed that Mr. Grey knows his fellow Anglo-Indians, when he points out that these records show "how little human nature changes." "I know well," wrote ship-master Trumbull, "what manner of man Mr. Day is. Drinking with the Moores at Ballissarra, hee so disguised himself in their presence, that they sent him awaie in a palankeene, out of which hee fell. And another tyme he made himself so drunk at Persia, that he ran intoe the sea and was like to have drowned himself." Mr. Day found not only good liquor, but good-humoured ladies in the East. No novel could be livelier than the true tales of the Merchant Venturers of London as Mr. Grey tells them. E. G. R. T.

EUROPE IN THE NINETEENTH AND TWENTIETH CENTURIES (1789–1932). By A. J. GRANT and HAROLD TEMPERLEY. Fourth and enlarged edition. *London: Longmans, Green & Co.* 1932. 9×5½ *inches;* xxiv+652 *pages; maps.* 12*s* 6*d*

This work, under the title of the first edition—'Europe in the Nineteenth Century'—was reviewed in the *Journal* for October 1927. A new part on the war and its aftermath in Europe and Asia, 1914–32, has been added, and other chapters revised in the light of fresh information. As the authors aim to present the political and cultural view rather than the military, the events of the war might have been more summarily treated. One statement requires modification; that Kemal "has expelled all foreigners whatsoever from Turkey." The exchange of populations with Greece was not quite the same as expulsion. G. R. C.

THE GEOGRAPHICAL BACKGROUND OF MODERN PROBLEMS. By H. J. FLEURE. (Workers' Educational Association Outlines. General Editor: W. E. WILLIAMS.) *London: Longmans, Green & Co.* 1932. 7×4 *inches;* viii+86 *pages.* 2*s*

This outline should be valuable to those embarking upon a study of the role of geography in modern life. Its value for students would have been increased by the addition of a short bibliography. Each chapter examines a typical example of a vital problem, *e.g.* the interrelations in a modern state of agriculture, industry, and population as presented in Great Britain and France; and the spread of the Westernized system in South America and Australia. The chapter on the Chinese-Japanese situation is particularly succinct and impartial, and to be commended as an introduction to a complex subject. Professor Fleure draws throughout upon a wide knowledge of geographical and allied sciences, and successfully compresses much matter into a few pithy sentences, avoiding the pitfall of sweeping generalization. G. R. C.

GENERAL

AN INTERMEDIATE GEOGRAPHY. By L. DUDLEY STAMP. *London: Longmans, Green & Co.* 1932. 8½×5½ *inches;* xii+262 *pages* (Commodities and World Trade); viii+318 *pages* (Europe and the Mediterranean); viii+178 *pages* (The Americas); iv+188 *pages* (Asia); *illustrations and maps.* 17*s* 6*d*

This book is produced to meet the needs of students who are preparing for the Intermediate examination in Geography in the University of London and similar examinations in London and elsewhere. It is not a new book, but consists of reprints of Part I of the author's 'Intermediate Commercial Geography' and three parts (V, I, and IV in that order) of 'A Regional Geography.' The first

part deals with general geography, but chiefly with climate, climatic regions, and economic geography. The remaining parts are regional accounts of (1) Europe and the Mediterranean Lands, with a detailed account of the British Isles; (2) North and South America; and (3) Asia, which includes a long section on the Indian Empire and Ceylon, and also reproduces some of the matter already given under "Mediterranean Lands." No doubt the publishers had good reason for producing the work in its present form, but as it consists of four books, each separately paged and three separately indexed, there are some obvious disadvantages. In the first "Part," which has no index, readers are referred to "Part II" or to "the section on Australia" or to New Zealand. Some, but not all, of these references can be traced, and it is disconcerting to find that "Part II" is not here reprinted and that there are no sections on Australia and New Zealand. As the regional parts are of later date than "Part I" some of the statistical material in the latter is not the most recent given in the book as a whole.

This irritating arrangement gives an unfortunate impression of a work which is filled with a vast amount of information, arranged with that skill for which the author is well known, and illustrated by about seven hundred diagrams and maps. Opportunities are given to the student to work out some statistical exercises for himself; a large number of questions from examination papers are supplied; a short bibliography is added to the sections on Europe and North and South America; and elsewhere footnotes occasionally give references to authorities. The book will certainly serve the purpose for which it was written and, by reason of its many facts, will form a useful work of reference to those who have passed the "Intermediate" stage. J. N. L. B.

SEARCH. By LINCOLN ELLSWORTH. *New York: Brewer, Warren and Putnam* 1932. 9×6 *inches;* xxviii+184 *pages; illustrations and maps.* $4.00

The objective of an exploratory expedition should be the common interest of every member, but the motives which inspire the individuals to sail together must vary as widely as their characters. Lincoln Ellsworth, in this brief history of his life as a traveller, does not attempt to analyse his motive, accepting it rather as an irresistible impulse inherited, as definitely as a physical characteristic, from his pioneering ancestors. "Exploration beyond the uttermost rim of discovery was my boyhood dream." One is inclined to be cynical of romanticism as a driving force when circumstances are liable to become boring as well as difficult, and yet one is bound to admit that it has proved perfectly adequate in this case. Ellsworth is definitely romantic: he talks of far-away Labrador, he is an unblushing hero-worshipper, and he spells the unknown with a capital U. And yet he is sufficiently practical to have demanded the justification of scientific research for every expedition which he undertook.

He trained himself mentally and physically to become an explorer. After college he joined a survey party which was prospecting for the transcontinental railway across Canada: he hunted buffalo with the Indians, and he studied the literature of Polar exploration. But in 1924 "the way to the arctic was still closed," so he sailed for Peru instead as co-leader of the Ellsworth Expedition of the Johns Hopkins University.

Next year he became associated with Amundsen in his projected flight from Spitsbergen to the North Pole, a scheme which would have been financially impossible but for Ellsworth's generosity. The description of this flight, told chiefly in diary form, is the most vivid portion of the book and proves that men of different nationalities can maintain their morale throughout days of doubt and anxiety so long as they are able and willing to work hard together. In contrast to this the description of the flight of the *Norge* from Spitsbergen to Alaska—well

planned and successfully executed—comes almost as an anti-climax. In fact the book seems to fall off towards the end with an almost telegraphic account of the Graf Zeppelin's polar flight and Sir Hubert Wilkins's attempt to cross the polar basin by submarine.

The style is good for a book of description and adventure, though conversational phrases are found mixed with the more careful English. The photographs are inserted without any reference to the text opposite them, and one is sorry to find in a map reproduced from the *New York World* that Peary Channel still cuts right through the north of Greenland. J. M. S.

VOODOOS AND OBEAHS. By JOSEPH J. WILLIAMS. *New York: Lincoln MacVeagh* 1932. $9\frac{1}{2} \times 6$ *inches;* xx + 258 *pages.* $3.00

The facts brought together in this book would have more value if attached to a stronger scheme. Thus, if it can be established, as seems to be the case, that behind all the bedevilments of fetish cult there is to be found ultimately, if not worship, at least a vague recognition of some Supreme Being, *e.g.* Nyame ("Big Massa") of the Ashanti, Se (Beginning, Intelligence) of the Dahoman, it should be practicable to synthetize—by tracing divergences backwards to convergence—the distribution of the African cultural outlook. Such a scheme would perhaps outrun the author's intentions, but something of that kind would have given more coherence to his abundant material. As a matter of fact the book is so overloaded with documentation, not so much by footnotes as by tiresome chains of actual quotation in the text, that it is extremely difficult to follow the connecting thread of thought at all. This is the more unfortunate since there is much promise in the general idea of studying these practices in special regions like Jamaica and Haiti, where transplantation to new and fertile soil under the forcing-house conditions of slavery has given them such rank growth as to make the initial tendencies in Africa more easy to disengage. As a closing paragraph hints at a further work on these lines it may be helpful to suggest that what is common to Voodoo snake cult, Obeah monkey witchcraft, Duppy ghost-belief, and Myal spiritualism would be better grasped, at least by the general reader, if the distinguishing features were more clearly set out. To the specialist student however the book will no doubt be welcome as providing, in a sober and scholarly atmosphere of carefully authenticated fact, a counterpoise to the sensationalism with which this subject has sometimes been treated. A. J. P.

A POCKET GUIDE TO THE SOVIET UNION. Issued by Intourist (State Tourist Company, U.S.S.R.). First Edition. Edited by L. A. BLOCK. *Moscow and Leningrad: Vneshtorgisdat* 1932. 6×4 *inches;* 706 *pages; plans and maps.* $2.50 (6*s*)

This excellent 1932 publication, light and of a size convenient for pocket or bag, yet containing 700 pages of good type and four maps, is an improvement on the larger guide-book dated 1928. It is divided into two parts with a long appendix giving information on every kind of subject not already touched upon, from the Russian alphabet and Customs regulations to the Chamber of Commerce and Nationalities, as well as a directory, a glossary, and an index.

Part I gives a general insight into life in the U.S.S.R. with emphasis naturally (since the book is a Government publication) on modern developments, new thoughts, and the so-called new aspirations and new spirit abroad. Government, laws, economic geography, autonomous republics, mineral wealth, the First Five Year Plan, electrification, agriculture, farms, transport, and other subjects too numerous to specify are dealt with; and the final claim is that "the feasibility of building socialism in one country alone has already been proved by the hard

facts." History is only touched upon when the subject-matter would be incomplete without some reference to it.

Part II, descriptive of the country at large from the Murman coast to the Black Sea, and from the Polish border to the Pacific Ocean, is itself divided into a dozen sections. Figures and some information may be already out of date, since things change quickly in Russia—the education system, for instance, which was reorganized in 1930 would seem to have been considerably altered within the last six months—but for use by tourists the volume is all that is needed, while it has distinct value for those who wish to study the country with or without visiting it. It is eminently readable, being written in good, sometimes even picturesque English with a faint American tinge. E. W. N.

ROUND THE WORLD WITHOUT A PINPRICK: being the diary of M. F. BRIDIE, passenger on the first world cruise of the R.M.S. *Empress of Britain* 1931–1932. *Birmingham: Jones & Co.* [1933]. 9×5½ *inches;* 308 *pages; illustrations and sketch-map.* 10s 6d

The curious title is the authoress' judgment on a luxury cruise in the *Empress of Britain*, "really rather a lovely boat" in spite of an apple-green Plimsoll line and of an official Cruise Lecturer giving out at dinner guide-books, full instructions and itineraries, carefully prepared memograms with notes, and inexhaustible information on dates of dynasties, manufacture of cigars, and the difference between real and imitation malacca. "He adds tremendously to the interest and value of the tour," and the book seems to owe something to his researches. Thus we learn that the Olympeion "was built by that wonderful old Roman warrior Hadrian, the same who built Hadrian's tomb at Rome." But if he told the authoress that the temple of Nike Apteros on the Propylaea was formerly the shrine of the Winged Victory, he was wrong.

Miss Bridie is too enthusiastic to be critical. She can write: "To-day has been another absolute foretaste of Heaven. This morning I spent half an hour in the gym, then had a swim before church, and after lunch I wore my blue figured muslin." She makes curiously inverted comparisons; the Parthenon "reminds one very much of its copy on the Calton Hill in Edinburgh." The Imperial palaces at Peiping "were such a maze that the one at Hampton Court would pale before them." Under the strict guidance of the Cruise Lecturer she found Cairo "just for all the world like any other big Continental city," and realized that Napoleon "appears to have spent a considerable time in Egypt." The memograms sometimes failed her. Of Stromboli: "I was vexed that I had not heard that we were to pass it at 3 a.m., or I should have been there. They tell me it is still partly active." And a little later: "The Red Sea is not a bit what I expected. It is like any other ocean, and so wide that we *cannot* see *land!!*" But as the authoress got farther east she seems to have escaped at times from the guide's tyranny, and her book is well worth reading for its amusing picture of organized travel in 1932.

THE MONTHLY RECORD

MEDALS AND AWARDS, 1933

His Majesty the King has been pleased to approve the award of the Royal Medals as follows: The *Founder's Medal* to Mr. J. M. Wordie, for the work he has done in polar exploration from the voyage of the *Endurance* in the Weddell Sea in 1914–1917 to the present day; the *Patron's Medal* to Professor Erich von Drygalski, for his researches in glaciology both in the Arctic and the Antarctic regions. The Council have awarded the *Murchison Grant* to Dr. Noel Humphreys, for his expeditions in Ruwenzori; the *Back Grant* to Miss Freya Stark, for her journeys in Luristan; the *Cuthbert Peek Grant* to Dr. L. S. B. Leakey, for his studies on climatic changes in East Africa; the *Gill Memorial* to Khan Sahib Afraz Gul Khan, Survey of India, for his frontier and trans-frontier explorations and surveys.

THE MOUNT EVEREST FLIGHT

The copyright in all dispatches from members of the Mount Everest Flight is vested in *The Times*. By their courtesy we are permitted to publish the following brief summary of the preparations and the successful flight.

On March 7 Air-Commodore and Mrs. Fellowes, Lord Clydesdale, Colonel Blacker, and Flight-Lieutenant McIntyre arrived in Karachi in the three Moth aeroplanes which were to be used for reconnaissance. The flight from England had occupied nineteen days and had been full of difficulties, but its success can be judged from the fact that the three machines were never separated for more than a few hours, and that they arrived in India in good condition. The two large Westland aeroplanes which were intended for the flight over Mount Everest itself had been sent out by sea and did not arrive until March 9. While the large aeroplanes were being prepared by the mechanics Air-Commodore Fellowes and Lord Clydesdale made a first reconnaissance flight in the expedition Puss Moth. At 11,000 feet they found a wind velocity of 50 m.p.h. and saw clouds upon the summits of the higher mountains. For the next few days the weather at high altitudes was still more boisterous. It appeared that the difficulties attending a flight over Mount Everest would be considerable.

On March 29 the Houston-Westland and Westland-Wallace aeroplanes went up for their first trial flight from their aerodrome near Purnea. They found a very strong wind at 34,000 feet, but the flight was successful as a test both of the machines and of the apparatus.

The climax of the expedition came quite suddenly. At 8.25 on the morning of April 3, after a long spell of bad weather, the two Westland aeroplanes set out from Lalbalu aerodrome near Purnea on what was originally intended to be a trial flight. The Houston-Westland was piloted by Lord Clydesdale with Colonel Blacker as photographer. Flight-Lieutenant McIntyre was the pilot and Mr. Bonnett the photographer of the Westland-Wallace. They flew direct for the summit on a course of 342°, which however had to be altered at intervals to allow for wind drift. At 19,000 feet Mount Everest became visible above the haze which hindered air photography until the aeroplanes were within 20 miles of the summit. At 9 o'clock they flew over Chamlang at 31,000 feet, but a downward current of air over Lhotse, the South Peak of Mount Everest, reduced their altitude by about 1500 feet, a loss which they only just made good when they reached the summit at 10.5. Whether the aeroplanes cleared Mount Everest by 500 or by only 100 feet—the estimates differ—it is clear that the pilots were much closer to the summit than they had intended. But strangely enough they found

smoother flying conditions which allowed them to circle round for 15 minutes taking close-range photographs.

At 11.25 they landed at their aerodrome after a flight which as a demonstration of skill and careful preparation is beyond all praise. The engines worked perfectly and the heated clothing and oxygen supply were so successful that the photographers were able at that extreme altitude to stand up in the open for several minutes at a time. There were only minor mishaps: a survey camera failed for a while; a fracture in Mr. Bonnett's oxygen supply (due probably to his standing on the tube) put him temporarily out of action, and the hand of one pilot suffered from what an onlooker at the return supposed was frost-bite, but proved to be a burn.

A heavy dust fog rising to 19,000 feet obscured the ground until the high mountains were near, and the strip photography with the vertical camera could not begin until 20 miles from the summit, while it is likely that the machine was at the critical time too near the summit for the desired overlap. But we are pleased to receive from Colonel Blacker a message dated Purnea, April 7: "Strip vertical photographs south of Everest satisfactory. Obliques surpassing expectations dispatched to *Times*." They should have arrived before this note appears. We look forward with pleasurable anticipation to the problems of identification.

On the morning of April 4, when *The Times* published the first accounts of the success, the President of the Society sent a telegram of congratulation to Air-Commodore Fellowes. The Mount Everest Flight have had one great day. It will be a thousand pities if they are not given further opportunities to extend and complete their photographic surveys, which may provide much more than can be utilized at once, but material invaluable for the future.

THE EAST ANGLIAN FLORA

Professor E. J. Salisbury's presidential address published in *Trans. Norfolk Norw. Nat. Soc.*, vol. xiii, part iii, 1932, on the characteristics of the flora of East Anglia is more than a local study inasmuch as it exhibits this flora in relation to the British Isles as a whole and to Europe. Starting from the conclusion that it is highly improbable that any considerable portion of the flora has survived from Preglacial or Interglacial times, Professor Salisbury considers the flora from the comparative geographical standpoint of the constituent species which are divided into eight Components further subdivided into Elements; a number of sketch-maps are given showing the distribution in the British Isles of particular species, selected to represent the different groups. Among the Components, which are based on the main area of occupation by the constituent species on the continent of Europe, may be mentioned a Northern component, comprising about twenty-four species in East Anglia alone, including an Arctic element; a Southern component with a hundred species, including a Mediterranean element; a Continental component with ninety-nine species, including a Steppe element; and an Oceanic component of seventy-four species. The northern limit of Southern species in Britain and the southern limit of Northern species runs across the country from S.W. to N.E. if the preference is for continental climatic conditions, and from S.E. to N.W. if for oceanic conditions. Of the Oceanic species, whose province is Western Europe, over 80 per cent. occur in Ireland, whereas only fifty-eight of the Continental species, whose home is farther east in Europe, are found in that country.

Of special interest in East Anglia is the Steppe element of the Continental component, comprising as it does twenty-five species, as against only two in Ireland restricted to dry soils. Its distribution in East Anglia can only be understood with reference to certain differences of climate and soil within that region

which are not generally realized. There is a large area in Norfolk and Suffolk centred on Norwich where the average annual rainfall is well in excess of 25 inches, and where the moisture is retained by heavy clay soils. Here there are no steppe plants and the Oceanic flora is well represented.

In the west, south, and east of this moist area, on the other hand, there is an equally large tract of country with a rainfall well below 25 inches and with markedly continental extremes of temperature, and it is where these dry climatic conditions are accentuated by porous sandy soils, as in the Breck country to the west or in the East Suffolk heathlands, that the steppe flora attains its greatest development in England.

SWISS RAILWAYS

The first supplement to the *Geographische Wochenschrift*, referred to in the *Journal* last month (p. 383), has been published—'Eisenbahngeographie der Schweiz,' by Dr. I. Siedentop. Railway construction in Switzerland has naturally presented many difficult problems; the author has related these to the physiography of the country. It will be easily apparent that the topography has not favoured the development of an ideal railway system in Switzerland. The brief historical introduction shows how the southern cantons remained isolated. The special constructions required—protection from avalanches and rock-falls, in addition to tunnels, bridges, and cuttings—are described and tabulated. It must have necessitated considerable labour to produce some rather obvious results. It is shown that 5·4 per cent. of all the railway track is in tunnels, and that for the Alpine area the figure rises to 10 per cent. Other tables give the number of tunnels on each route, the number over 2 kilometres in length, and of bridges over 200 metres. The older tracks often kept very close to the valleys, so that they have had to be shortened by modern methods. With the exception of a few secondary lines, the whole system has been electrified.

BEE-HIVE DWELLINGS OF APULIA

Under this title Mr. L. G. Bark describes in *Antiquity* for December 1932 a type of building which must be one of the most striking examples that could be adduced of the influence of geographical environment upon human habitation. The interior of Apulia is for the most part occupied by a bleak stony limestone plateau forming the south-eastern termination of the Apennines. The traveller on the Bari-Brindisi railway, traversing the fringe of this limestone tract, notices quaint little conical-shaped huts fashioned after the manner of round bee-hives composed of flat stones and used as barns, cattle shelters, or store-houses. They are said to date from time immemorial and are known as *trulli*, a term of obscure origin but apparently having reference to the circular shape. Mr. Bark undertook a journey into the remoter parts of Apulia in order to see the heart of the trulli country. Here one sees not occasional huts in the landscape but whole villages built of trulli in a countryside where stone of a particularly fine quality is found in embarrassing profusion. The capital of the trulli country, a town of 12,000 inhabitants known as Alberobello, is likewise built almost entirely in the same fantastic style, though here more variants from the simple standard form are met with.

Mr. Bark was informed that the strange dwellings of Alberobello dated from prehistoric times and were designed to use as much material as possible for the economic purpose of ridding the surrounding country of a valuable, easily retrieved, building stone hindering the cultivation of the rich soil. Thus the walls of a trullo are very thick, which is an advantage in keeping out the heat in summer and the cold in winter. In spite of the absence of mortar and cement the

structure is very strong owing to the way the stones are laid in circular fashion as it contracts towards the roof. Few of the trulli in Alberobello have more than one door and in most instances holes in the walls do duty for windows, left open in summer and closed with stones in winter. Owing to the mortarless stones becoming receptacles for soil and seeds carried by the wind most of the trulli in the town are adorned with charming natural roof-gardens full of wild flowers. Civilization has now reached Alberobello, which enjoys electric light in common with all Italian towns and villages, but the coming of the cinema will inevitably tend to spoil the unique character of this city.

THE RUWANDIZ ROAD

Two accounts of this road in north-east 'Iraq, both by Mr. A. M. Hamilton, one of the engineers, appeared in the April issues of the *Journal of the Royal Central Asian Society* and the *Empire Survey Review*. It is a highway of the greatest importance, as it promises to open up a trade-route for modern transport between northern Persia and the Mediterranean, not to mention the Persian Gulf *via* the 'Iraq railways. Running at right angles to the ranges of the Zagros and through the territory of a warlike but backward people the road presented exceptional difficulties in survey and construction. The line of the route from Mosul is by Quwair, Erbil, and Shaqlawa, thence over the Spilik pass to Ruwandiz and up the Ruwandiz river to the Persian frontier at the Zin-i-shaikh pass. It is proposed to make an alternative route from Mosul to the Spilik pass by extending the Mosul–'Aqra road *via* the Bekhme gorge on the Great Zab. A branch to the south-eastern corner of Turkey starts northwards between the Spilik pass and Ruwandiz. On the Persian side the route is continued near the south and east shores of Lake Urmia to Tabriz.

Mr. Hamilton is an enthusiastic advocate of road-building and other peaceful occupations in preference to military display and broadcasting as a settling influence on the tribesmen. He employed mixed gangs of Persians, Kurds, Arabs, Assyrians, and Armenians, and found that they worked diligently with few quarrels or crimes, and appreciated the medical and surgical attention provided. The local shaikhs with tactful handling became keenly interested in the work. A road of this kind can be a civilizing influence not only when made but in the making.

UPLIFT OF BARBADOS

A new interpretation of the recent geological history of Barbados is offered by Mr. C. T. Trechman in the *Geological Magazine* for January 1933. The island has a generally uniform covering of coral rock raised in the higher parts to an elevation of 1100 feet, and attaining a maximum thickness of 240 feet, the uplift and subsequent denudation and ravining having all occurred, apparently, within Pleistocene time. The surface now forms a succession of steps or terraces rising from south-west to north-east and attaining a maximum height at no great distance from the north-east coast towards the lowland on which side it falls by a steep cliff. The simple explanation given by Messrs. Harrison and Jukes-Brown in their monograph on the geology of the island (1890) was that each of the platforms was once a fringing reef like that which now surrounds the greater part of the island, and that each step in the ascent was of older date than the one below it; this supposes that the uplift was everywhere vertical. Mr. Trechman, who has known and studied the island for some years, dissents from this view, holding that the evidence of the fossils and other features indicates a nearly equal age for the whole of the coral rock covering, most of which was, he thinks, formed before the uplift commenced. The main uplift in his view has not been directly vertical, but due to pressure from the west and south, which has tilted the island

towards the east and north; a ridge or dome in the south being due to later upward bending. The coral covering must recently have extended farther east than at present, but has been fractured and denuded off, exposing the underlying Oceanics and Scotland beds, and an example of this process is quoted as having occurred in 1900, when a great collapse of coral rock took place from the escarpment in the north-east corner. The vertical and smooth nature of some of the bench edges may perhaps point to fault scarping as an element in their formation, but in other parts they are more clearly due to coast erosion possibly caused by periodic rises of sea-level as the uplift continued.

SOUTH-EAST GREENLAND

In the summer of 1931 Dr. Knud Rasmussen made a reconnaissance of South-east Greenland from Cape Farewell to Angmagssalik. A preliminary description of this Sixth Thule expedition is given in the *Geografisk Tidsskrift* for December last. The journey was made in a 10-ton motor vessel, and Dr. Rasmussen was accompanied by six Danes and four Greenland hunters. The indented character of the coast is shown from the fact that though the direct distance between Julianehaab and Angmagssalik is 700 miles, the vessel sailed 2500 miles. The northward journey was uneventful. The longest halt was made in the Dronning Maria valley behind the island of Skjoldungen. This, the sole oasis along this stretch of coast, was carpeted with flowers, berries, and bushes. The heat was very great, and swarms of mosquitoes abounded. This valley had formerly been an important Eskimo centre.

On the return journey from Angmagssalik, the party encountered very bad weather, and for three days were at the mercy of the gale. The damage the vessel suffered on this occasion unfortunately made it impossible to complete the survey which had been planned. The west coast was reached on October 2.

Eleven magnetic stations were occupied on the east coast during the journey, and four thousand deviation observations recorded, but the main work of the expedition was archaeological and the study of the material culture of the Eskimo. Twenty-five sites were excavated in the neighbourhood of Lindenov Fjord. It is stated that there were formerly 101 settlements along this coast, with a total of 158 houses. That summer there were ninety-five people south of Angmagssalik, of whom forty-seven were round Inigssalik, and thirty-one at Igtuk. Conditions all along the coast were considered by the native hunters to be favourable to native life. The decline appears to have been caused by the establishment of trading centres at Angmagssalik and Julianehaab which attracted the population, and upset the balance of the native culture. Dr. Rasmussen considers that the region is "the land of the Eskimos, in the proper sense of the word" and cannot support Europeans, even trappers, for any length of time.

It will be remembered that the late Mr. H. G. Watkins and his party, making a similar journey from Angmagssalik that summer, were overtaken by Dr. Rasmussen at Nanortalik on his return, and accompanied him to Julianehaab.

THE DRIFT OF THE *BAYCHIMO*

Mr. Vilhjalmur Stefansson sends us the following note:

The latest but perhaps not the last chapter in the adventures of the Hudson's Bay Company's Arctic trading steamer *Baychimo* has been brought south by Charles D. Brower, the well-known "most northerly American citizen" whose home has been at what is now called Barrow Village, 8 or 10 miles south of the tip of the Point Barrow sandspit, these forty-nine years. Brower is known for careful observation and accurate statement to all travellers who have reached or passed his whaling and trading station since 1884.

The *Baychimo*, returning in the summer of 1931 from a trading voyage to the eastward, was caught in the ice about 20 miles north of Wainwright, Alaska, and compelled to winter. The crew moved ashore with the things most valuable and portable, and built a house. During a violent gale on Thanksgiving Day, November 26, a tongue of ice (it is inferred) came in, scooped up the ship, and carried her off. After the ship had gone the ice pressed terrifically against the beach, piling up to more than 75 feet—so high, in fact, that when the men came out from the house after the storm they at first assumed the vessel to be crushed and buried out of sight beneath the ridge. That the ship had not been buried was proved on December 15 when she came drifting in with the ice north of Sea Horse Islands, about 12 miles south-west from Barrow Village and 9 miles offshore. At this time a white man, assisted by three natives, salvaged fifteen bales of fur and perhaps some other things. The vessel remained till Christmas and then drifted off with the pack to the south-west. In March the *Baychimo* returned to within 6 miles from shore. One Eskimo boarded her and got a bear skin, an ivory cribbage board, and some clothes.

This was just a pause in the *Baychimo's* drift. She next returned on 17 August 1932, this time abreast of the Charles Brower whaling station at Barrow and 9 miles offshore. A considerable party with three light-power boats got out to her in sixteen hours of dragging the boats over floes and launching them in clear patches between. They were aboard the ship about five hours and loaded up with material that was secondhand but of great value to them—rifles, shot guns, cameras, clothing, etc. Meantime a strong wind had blown up from landward. It took the party four days of alternate portagings and launchings to get back over the pack into the open water nearer the land, and then eight hours under power to reach shore. They landed at Skull Cliff, 45 miles south-west from Barrow. The *Baychimo* when last seen was tilted well over on her side, high and dry on a floe several square miles in area. The boarding party had to walk about a mile over the ice to the ship from where they left their boats at the edge of the floe. The vessel was in part elevated, so they could see under her. There appeared to be nothing wrong except that the propeller had been twisted off.

In view of the apparent thickness of the floe and the condition of the vessel, it seems about an even guess as to whether the ice has since then been so crushed that the ship has fallen into the water. For all we know she may still be drifting around on the floe, and it is at least possible that she may thus continue for several years. In view of the known drift of the *Karluk* in these waters, of the *Jeannette* and *Fram* farther west, and of the Melville-Bryant casks, the *Baychimo* may appear in anything from three to five years somewhere to the north of Norway or of Iceland.

LANDSLIPS

One of the most careful and systematic studies of landslips, their causes and effects, that has yet appeared, comes from the Swiss geologist, Professor A. Heim, who deals with the subject in a memoir of over 200 pages entitled 'Bergsturz und Menschenleben,' printed as a *Beiblatt* (No. 20) to the *Vierteljahrschrift* of the Natural History Society at Zürich, 1932. The study, which is accompanied by maps, profiles, and illustrations, is based mainly on the writer's personal work and experience, extending over fifty years, and is concerned chiefly with the Alps, for Professor Heim makes no claim to have utilized the work of others for a comprehensive work on landslips in general. Such does not appear to exist so far, for Professor Almagià's important contributions to the subject have been mainly devoted to the phenomenon in Italy. As it is, Professor Heim's memoir will not soon be superseded. He founds his classification on fundamental differences, on

the basis of which he defines twenty types of landslips, the primary division being between movements of detritus and falls of solid rock, while other criteria are the rate of movement (slowly gliding or catastrophic), the operation of water as agent, and so on. Various accompanying phenomena are also considered. In discussing the causes of landslips the author draws a distinction between the deep-seated agencies which may have been at work for years, and may ultimately go back to remote geological periods, and the proximate causes to which the final overthrow has been due: too much attention, he thinks, is given to the latter to the neglect of the former. A special section treats of man's attitude to landslips, and stress is laid on the common disregard of premonitions which may have long preceded the catastrophe, and which might have averted loss of life if attended to. In discussing, finally, what means should be taken to secure protection from such disasters, Professor Heim quotes some singularly judicious remarks made as early as 1807 by J. B. von Tscharner with a view to urging action by the authorities. His own suggestions are in the direction of careful observation of the ground by competent geologists both when a catastrophe is threatened and after one has occurred. Measures are often advocated by laymen which are not merely useless, but positively harmful.

RADIUM CONTENT OF OCEAN-BOTTOM SEDIMENTS

In an article in *Amer. J. Sci.* for March 1933, Mr. C. S. Piggot tabulates the results of sixty-eight analyses of ocean-bottom sediments for radium, and gives a map indicating the locality from which each of the analysed samples was derived, the character of the deposit to which each sample belonged, and the radium concentration determined from each analysis. The samples were taken partly from the *Challenger* collection, partly from the collection of the Prince of Monaco's yacht *Princess Alice II*, and partly from the collection made on the last cruise of the *Carnegie*, nearly all the last named being from the Pacific.

The analyses show an average radium content as high as $11{\cdot}76\times10^{-12}$ or 0·000000000011176 grammes of radium per gramme of dry material, which is about six times as high as the figure for continental granites and twelve times as high as that for basalts. The high radioactivity of the oceanic sediments is declared to be the more astonishing from the fact that land sediments contain much less radium than the igneous rocks. The author combats the theory that this high concentration of radium in the sea is due to the action of living organisms in incorporating the salts of radium and uranium in their skeletons, pointing out that there is no connection between the radium content and the character of the animal remains comprising the sediment, and that the red clays, which are predominantly mineral in composition, are the richest of all the deposits in radium. He considers, on the contrary, from the known relationship between radium and uranium in radio-active material, that the deeper waters of the ocean are at saturation with respect to oxides of uranium which thus have a tendency to separate out on the sea-bottom along with oxides of iron and manganese. That the deep waters in fact form an oxidizing environment is indicated by direct measurements of oxygen content made by the *Carnegie*.

It is realized that the paucity of the data when considered in relation to the vast areas covered by ocean-bottom sediments precludes any generalizations about their geophysical significance, which will be considerable if the deposits are thick and have served to carry the high radium content into the structure of the Earth's crust. It should be mentioned that of the three sets of samples in question only those from the *Carnegie* were investigated by Mr. Piggot, the other analyses being the work of Joly and Pettersson, tabulated for comparison.

MERCATOR'S WORLD MAP OF 1569

The International Hydrographic Bureau, Monaco, reissued in 1931 the full-sized reproduction of Mercator's world-map of 1569 published by the Berlin Geographical Society in 1890. The original is in the archives of the Municipal Library, Breslau, and three other copies only are known.

The Latin legends upon the map, with English translations, are printed in the *Hydrographic Review* for November 1932. Mercator states his three objects to have been, first, the representation of true distance and direction; secondly, the assignment of correct position and size to the various lands; and, finally, the interpretation of the geography of the ancients. The map is the earliest undoubted example of the use of the projection known by his name. The prime meridian is drawn through the Isle of Corvo, as he believed that there the magnetic declination was nil—which shows that the hope of calculating longitude from the declination had not then been entirely abandoned.

For many of the details of his map Mercator relies upon classical tradition. His great master is Ptolemy, and he refuses to believe that the voyages of the Portuguese in the east could have brought them beyond the limit of Ptolemy's map. He argues from the evidence of Ptolemy and Solinus that the Niger flows into the Nile. He identifies the Ganges with the "very great river Cantan" in China, and asks, if it were the river usually known as the Ganges, "whither shall so many isles placed by Ptolemy in the Gangetic Gulf be referred, since they are not in the Bay of Bengal?" Further, the Golden Chersonese must be Japan, not Malacca. Modern exploration might remove the "Sinus Magnus" from the map, but could not destroy altogether the power of tradition.

OBITUARY

LIEUT.-COL. NOWELL BARNARD DE LANCEY FORTH

By the untimely death of Lieut.-Col. de Lancey Forth, D.S.O., M.C., at the early age of fifty-four, the Society has lost a Fellow who was one of those men of whom the public hears little, since their work lies on the fringe of civilization and they are not given to advertisement, but who from long experience, and a natural aptitude for their work, are able to outwit the wild native tribesmen with whom they have to deal and to beat them on their own ground.

It is impossible here to do justice to his military career, which he commenced by enlisting, during the South African War, in the Queensland Imperial Bushmen. He was eventually given a commission in the Manchester Regiment, and afterwards seconded to the Egyptian Army, where he spent from 1906 to 1914 in various Camel Corps on active service in the Sudan, and during the Great War commanded a battalion of the Imperial Camel Corps in Palestine. For his services he received the Order of the Nile, the Military Cross, and the D.S.O. with bar.

In 1920 he was given command of the Camel Corps and Light Car Patrols of the Frontier District Administration, a position closely corresponding to that of Warden of the Marches of the Middle Ages. He had to prevent raiding, smuggling, gun-running, and slave dealing on the north-west frontier of Egypt, and generally to police the Border, an arduous and difficult task, seeing that not only had he to deal with the turbulent Maghrabin Arabs, and occasional Tibbu and Tuareg raiders from over the Border, but in addition he had to control a district that was to a great extent unknown ground, and that included the great

Sea of Sand, covered in places with dunes over 300 feet high that were generally considered to be impassable.

It was mainly in the hope of finding the unknown routes and waterholes used by the natives in this dune-covered area that Colonel Forth undertook the journeys which he described in the *Journal* for January 1930. Few of those who read his brief, matter-of-fact account will realize the very difficult nature of the work he then did. A journey of 400 miles, without a well, through those gigantic dunes by camel caravan, at a time of year when hot spells and violent sandstorms were to be expected, must be easily a record. His exploit of 1923, in piloting his caravan back to safety in such a country, when even his guide became hopelessly lost, was one that few men could have accomplished.

During this last journey he saw unmistakable signs of the proximity of an oasis, but the state of his camels prevented him from following them up, though he never abandoned the hope of doing so. But in 1924 he contracted an illness that kept him for many years practically an invalid. Recently he had so far recovered that he began once more to make plans for his long-deferred expedition. During the recent winter, while on a visit to Egypt, he several times discussed his scheme with the present head of the Senussia, who eventually offered to find him from his sect the best desert men for his journey. But fate was against him. He fell ill again before leaving Egypt, and died of pneumonia in a hospital in Alexandria. It is one of the tragedies of the exploration of this desert that, though he nearly discovered this place, he never actually saw it. Natives describe Forth's oasis as a large place. Its name is possibly Zerzura. W. J. H. K.

MEETINGS: SESSION 1932–1933

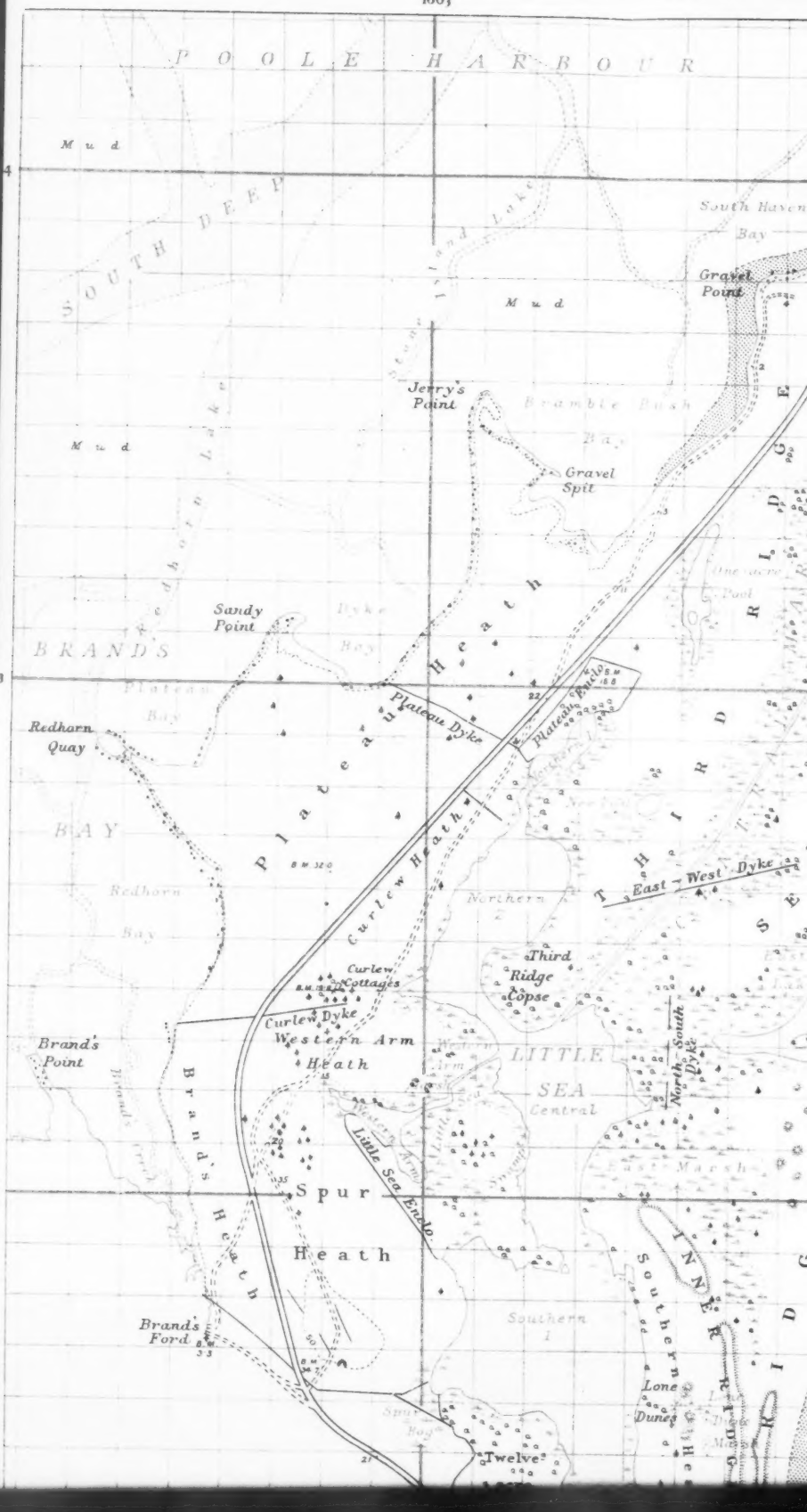
Eleventh Evening Meeting, 3 April 1933. The President in the Chair

Elections: Howell Davies; The Rev. William Hugh Stewart Dumphreys; Robert James Fulton, B.A.; T. R. Hill, M.D.; John F. Hops; D. R. de L. Macpherson; Henry Ambrose Martin, M.SC.; Ronald Morrison; Major Francis Montague Mortimer-Livingston; John Charles Parrack, B.SC.; George Reginald Stevenson; Jack Vincent; Miss Hettie Margaret Swinburn Waite; William Henry Whitbread; Miss G. M. Willis; Ernest Shepperson Wilson

Paper: Among the Mountains and Head-hunters of Formosa. By the Rev. W. H. Murray Walton

Sixth Afternoon Meeting, 10 April 1933. The President in the Chair

Paper: Discussion on the use of the new Grid on Ordnance Survey Maps. Opened by Brigadier H. StJ. L. Winterbotham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Gravel Spit
Sandy Point
BRAND'S BAY
Redhorn Quay
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Plateau Dyke
Plateau Heath
Curlew Heath
Curlew Cottages
Curlew Dyke
Western Arm Heath
Brand's Point
Brand's Heath
Spur Heath
Brand's Ford
Third Ridge Copse
East - West Dyke
Northern
LITTLE SEA
Central
North - South Dyke
Little Sea End
Southern
Lone Dunes
Twelve
South Haven Bay
Gravel Point
Bramble Bush Bay
Pool
Marsh
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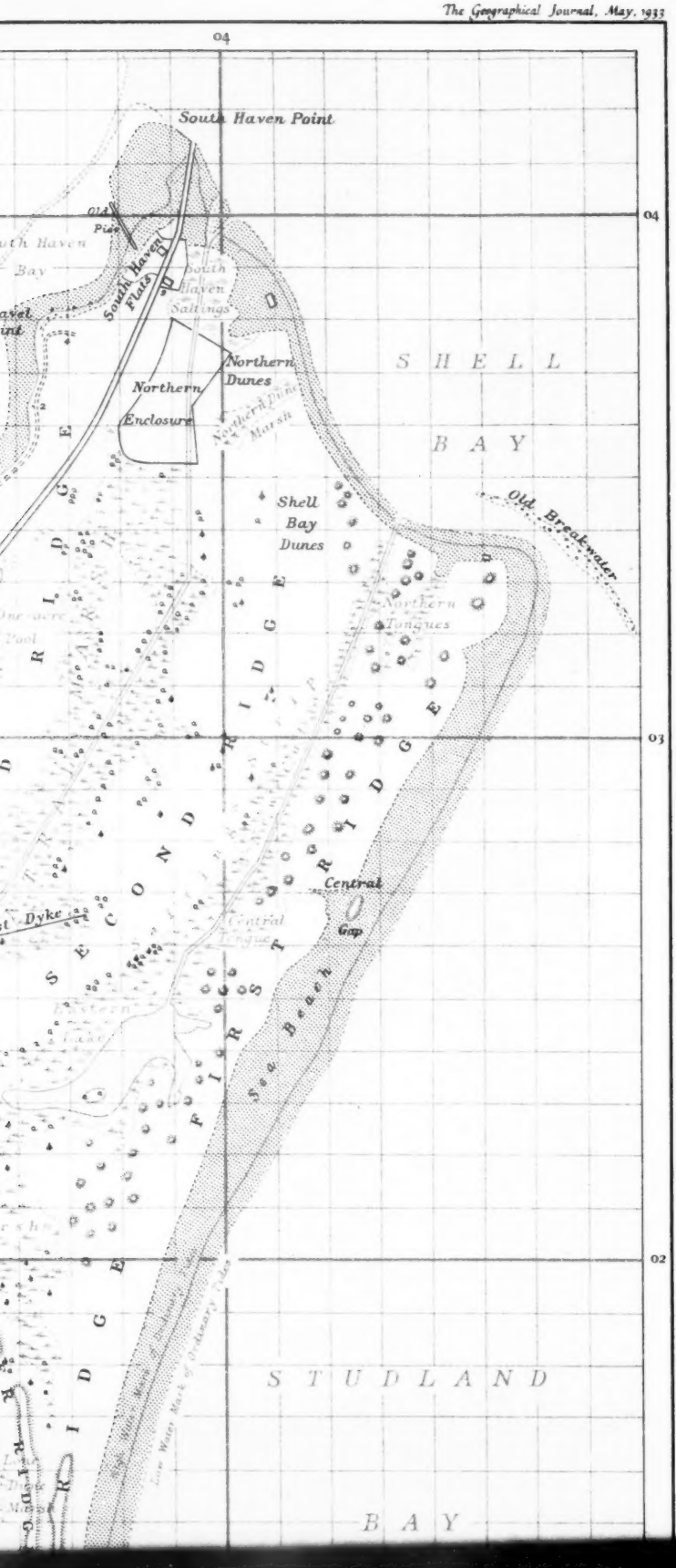
Southern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South Haven Point
Old Pier
South Haven Flats
South Haven Saltings
Northern Dunes
Northern Enclosure
Northern Point Marsh
SHELL
BAY
Shell Bay Dunes
Old Breakwater
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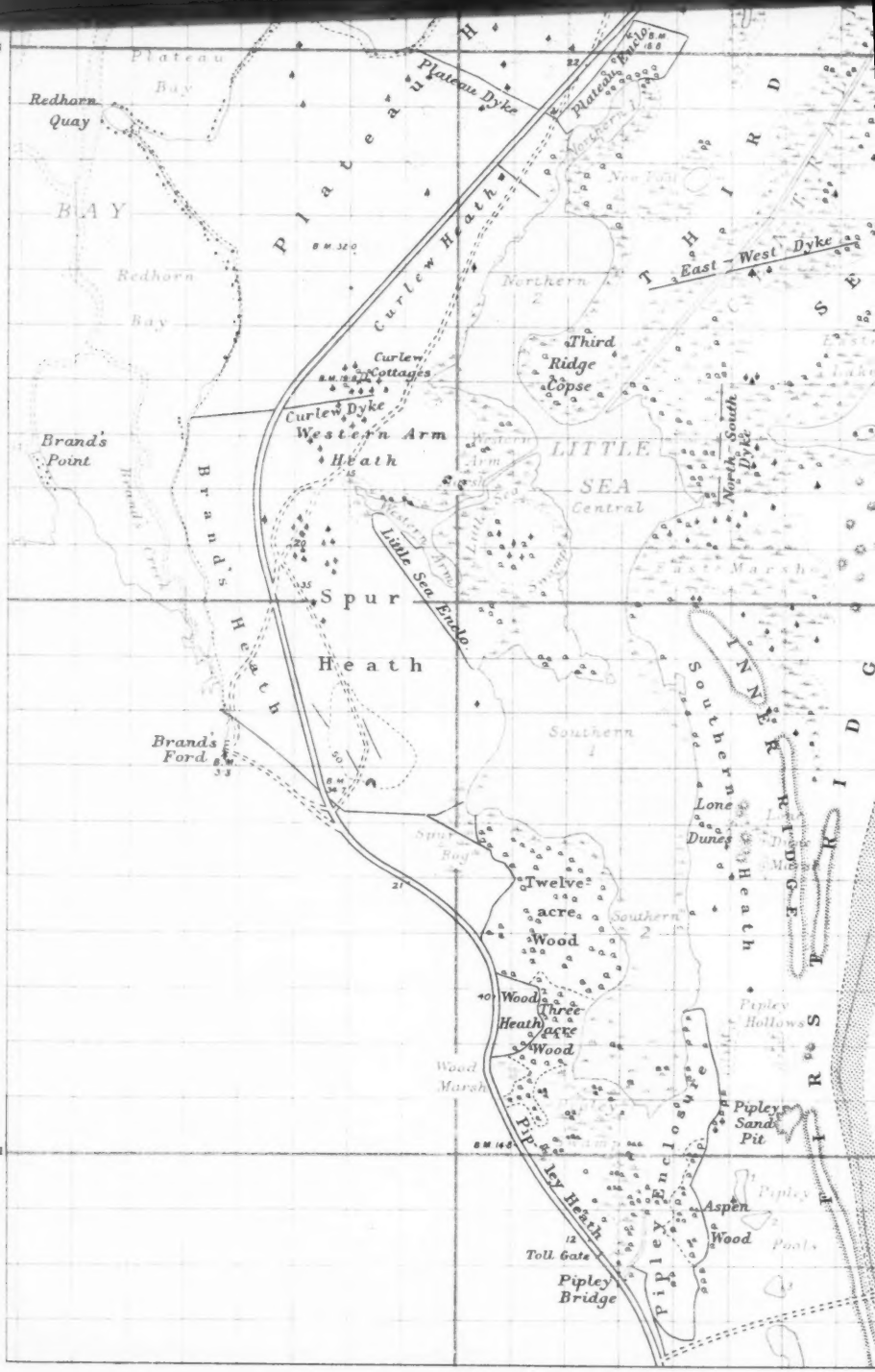

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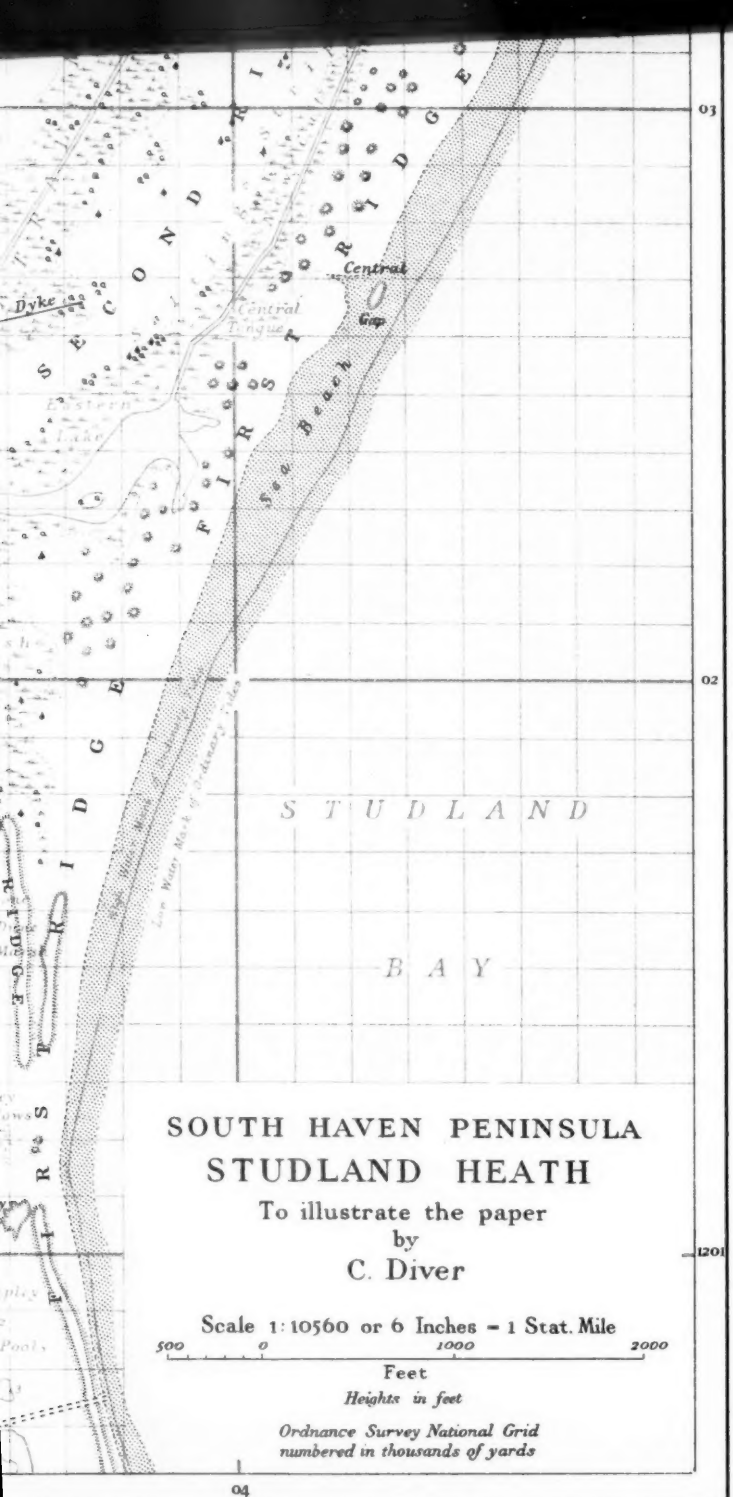

SOUTH HAVEN PENINSULA
STUDLAND HEATH

To illustrate the paper
by
C. Diver

Scale 1:10560 or 6 Inches = 1 Stat. Mile

500 0 1000 2000

Feet

Heights in feet

Ordnance Survey National Grid numbered in thousands of yards

aphical Society

SOUTH HAVEN PENINSULA
Diver